INTEGRATED HEALTH, SAFETY AND ENVIRONMENTAL MANAGEMENT SYSTEMS

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Abstract

The continued rise in accident and ill health statistics throughout the member states of the European Union indicate that the standards of occupational health, safety and environmental control require further improvement to minimise the current level of loss. Management systems are regarded as an effective means of reducing this loss by continuously improving standards. Whilst there is much discussion and debate about the possibilities of integrating management systems, at present, there are no national or international published integrated management standards, although some multi-national companies have introduced their own internal integrated standards.

The research explored the development of an integrated health, safety and environmental (HSE) management system within a range of industrial organisations. This included the development of tools for successful implementation of integrated systems, specifically for significance review, risk assessment and auditing. Resources and accreditation constraints precluded exhaustive testing of all clauses within the proposed integrated management standard. However, analysis of key aspects of the standard revealed:

1. The introduction and use of separate health, safety and environmental (HSE) management systems improved the standards of risk control within organisations.
2. Organisations perceived that there were clear business advantages in some form of integration of existing standards.
3. The developed integrated HSE standard was technically possible in the area of policy development, process operations, working instructions and documentation. However, the integration of risk assessment and audit tools gave limited advantages compared to existing separate systems.
4. The proposed integrated HSE standard complied with both individual European member states national legislative requirements and European/World-wide management standard criteria.

In summary this thesis represents an original contribution to the field of integrated management systems. The thesis also identifies areas of further work that will increase the knowledge base, scope of application of the work carried out.

Acknowledgements

This thesis represents the account of a journey that started almost seven years ago, when embarking upon a Masters degree in health, safety and environmental management at the University of Glamorgan. It was only after completing the degree and observing the popularity of environmental management systems and the growing use of formalised health and safety systems within practical situations, that led me to believe that integration of these two systems would be an advantage. However, the practicality of introducing such integrated systems proved to be a voyage of discovery, with often the theory and practise being on divergent routes.

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This thesis is dedicated to these family and friends without whose support I could not have arrived at this point.

List of Abbreviations Used

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ACBE	Advisory Committee on Business and the Environment
ASQC	American Society for Quality Control
ALARP	As Low as Reasonably Practicable
ANSI	The American National Standards Institute
AQAP	Allied Quality Assurance Publication
BGZ	Berufsgenossenschaftliche Zentrale für Sicher-heit und Gesundheit
BS	British Standard
BSI	British Standards Institution
CBI	Confederation of British Industry
CD	Committee Draft
CIMAH	Control of Industrial Major Hazards Regulations
COMAH	Control of Major Accident Hazards Regulations
COSHH	Control of Substances Hazardous to Health
DETR	Department of the Environment, Trade and the Regions
DG	Directorates-General
DIS	Draft International Standard
DTI	Department of Trade and Industry
EA	The European co-operation for Accreditation
EU	European Union
EC	European Commission
EP	European Parliament
EFQM	European Foundation Quality Model
EAHSW	European Agency for Safety and Health at Work

EEA	European Environmental Agency
EFTA	European Free Trade Association
CEN	Comitée Européen de Normalisation
CENELEC	Comitée Européen de Normalisation for Electrotechnical Standardisation
EA	Environment Agency
EMAS	Eco-Management and Audit Scheme
EMS	Environmental Management System
ENVOP	Environmental Optimisation
EPA	Environmental Protection Act
FDIS	Final Draft International Standard
FTA	Fault Tree Analysis
FMEA	Failure Modes and Effects Analysis
HAZOP	Hazard and Operability Study
HAZAN	Hazard Analysis
HSE	Health and Safety Executive
HMIP	Her Majesty Inspectorate of Pollution
HMSO	Her Majesties Stationary Office
IChemE	Institute of Chemical Engineers
ICC	International Chamber of Commerce
IEC	International Electrotechnical Commission
IEMA	Institute of Environmental Management and Audit
IFA	International Accreditation Forum
ILO	International Labour Organisation
IOSH	Institute of Occupational Health and Safety
IPC	Integrated Pollution Control

IPPC	Integrated Pollution Prevention and Control
ISO	International Standards Organisation
ISO/SAGE	International Standards Organisation Strategic Advisory Group
LAAPC	Local Authority Air Pollution Control
LCA	Life Cycle Analysis
NAS	National Academy of Sciences (USA)
OHSMS	Occupational Health and Safety Management Systems
OSHA	Occupational and Safety Health Act (USA)
QRA	Quantified Risk Assessment
SEC	Securities and Exchange Commission
SFARP	So Far As is Reasonably Practicable
SME	Small and Medium Enterprise
TC	Technical Committee
TMB	Technical Management Board
TQM	Total Quality Management
TOR	Tolerability of Risk
UKAS	United Kingdom Accreditation Service
WHO	World Health Organization

Chapter 1.0 Introduction

1.1 Introduction

Health, safety and environmental losses are a significant cost to the European economy and further improvements are required to reduce the current level of loss. Within the European Union the losses have been estimated:

There were approximately 6,000 fatal accidents, 5 million 'over three day' injuries and millions of cases of occupational ill health occurred as a result of a work activity, which were reported to the European Commission in 1993 (EC. 1997 and HSE. 1997a).

The exact picture of the environmental damage is far harder to quantify and measure, however, in 1999 The Executive Director of the European Environment Agency reported:

> "progress in policy making, yes, but no substantial improvement yet in the environment" (EEA. 1999a).

A Management system is seen as an effective means of continuously improving standards. Since the late nineteen eighties there has been considerable development of formalised management systems as a means of reducing the environmental and health and safety loss to organisations.

Management standards originated with the introduction of quality in 1984 and have been extended for the environment at national, european and international levels. Currently, for health and safety there are a number of national standards available, but there are no comparable international agreements. The main standards are listed in table one-one.

Table 1- 1 Key Management Standards

Quality Management Standard	
International	BS EN ISO 9000 series: 1994 Quality Management and Assurance Standards.
Environmental Management Standard	
Within Europe	The Eco-Management and Audit System: 1996
International	BS EN ISO 14000 series Environmental Management Standard: 1996
Health and Safety Management Standard	
Within the UK	1. HS(G) 65 Successful Health and Safety Management: 1992 and revised 1997 2. BS8800: A Guide to Occupational Health and Safety Management Systems: 1996. 3. OHSAS 18001, Occupational Health and Safety Management Systems – Specification: 1999 4. OHSAS 18002, Occupational Health and Safety Management Systems – Guidance for the Implementation OHSAS 18001: 2000
Within Europe	There is no European Health and Safety Management Standard. However there are a number of National standards which include: 1. Ireland: Draft Standard for Code of Practice for an Occupational Health and Safety Management System: 1998 2. The Netherlands: Dutch Technical Report: Guide to an Occupational Health and Safety Management System: 1997 3. Norway: Norwegian Proposal: Management Principles for Enhancing Quality of Products and Services, Occupational Health & Safety, and the Environment: 1996 4. Spain: Prevention of Occupational Risks: General Rules for Implementation of an Occupational Safety and Health Management System: 1996
International	There is no International Health and Safety Management Standard. However there are a number of National standards which include: 1. Australia/New Zealand: Occupational Health and Safety Management Systems - General Guidelines on Principles, Systems and Supporting Techniques: 1996 2. Brazil: Ministry of Labor Environmental Risk Prevention Program:1998 3. Jamaica: Draft Jamaican Standard Guidelines for Occupational Health and Safety Management Systems - General Guidelines on Principles, Systems and Supporting Techniques: 1997. 4. Japan: Japan Industrial Safety & Health Association:1997 5. Korea: Safety and Health Management Systems:1998 6. Poland: Safety and Health Management in SME's: 1996 7. South Africa: The NOSA 5 Star Safety & Health Management System. 8. United States of America: Occupational Safety and Health Administration, Draft Proposed Safety and Health Program Standard:1996

The continuing development and popularity of these individual standards is now coupled with proposals to integrate some or all of these standards. The aim of this research will be to establish whether effective integrated management systems can be implemented into organisations. The research aims are detailed in table one-two.

Table 1- 2 Research Aims

Number	**Research topic addressed**
1	Establish the current status use and application of individual management systems and standards
2	Evaluate the relationship between the existence of formalised health safety and environmental management systems within an organisation and the levels of physical control (risk), and explore the possible benefits
3	Explore the concept of integrated management standards within organisations
4	Develop an integrated standard with supporting tools and explore the feasibility of implementation
5	Review the applicability of an integrated management standard within the context of national and European legislation

1.2 Thesis Structure

Chapter one will describe the current position of environmental, occupational health and safety and quality management standards.

Chapter two examines the current literature with regard to individual standards, trends towards integration of these standards and the development of practical integration techniques such as significance review, risk assessment and audit.

Chapter three outlines the methodology used to examine research questions numbers two to five detailed in table one-two.

Chapter four contains details of the results obtained and discussion.

Chapter five is the developed proposed integrated health, safety and environmental management standard.

Chapter six contains the conclusions to this research and recommendations for further work.

1.3 The Influence of European Legislation

1.3.1 Background

Health and safety and/or environmental legislation cannot be introduced by individual national member states without a European Union Directive. This constraint is a result of member states commitment to the Treaty of Rome, which aims to prevent the introduction of potential barriers to trade within Europe (EC. 1957). Any developed management standard needs to recognise the importance of these relevant European Union Directives.

For health and safety the Framework Directive obliges the employer to plan, organise, control, monitor and review health and safety arrangements. For environment Directive Number 97/265/EC describes a specification for environmental management systems. However, there is no legal basis that requires the adoption of specific formalised management systems for health, safety or the environment.

Appendix one details the role of individual European organisations that influence the development of health, safety and environmental legislation and standards.

1.3.2 Current and Proposed Environment European Union Legislation

The policy for European environmental standards is contained within the fifth European Community environment programme: "Towards Sustainability" (EP. 1998). The origins of this programme can be traced back to the Treaty establishing the European Economic Community, as amended by the Single European Act. It explicitly provides for the development and implementation of a Community policy on the environment. One of the principal objectives of the Maastricht Treaty is the promotion of sustainable economic growth, whilst respecting the environment. The fifth programme of action in relation to the environment sets out a new approach to Community environmental policy. To support these policy objectives there are 51 primary European Directives regarding the environment, of which the key Directives are:

- Council Regulation (EEC) No 880/92 of 23 March 1992 on a Community eco-label award scheme;

- Council Regulation (EEC) No 793/93 of 23 March 1993 on the evaluation and control of the risks of existing substances;

- 97/265/EC: Commission Decision of 16 April 1997 on the recognition of the International standard ISO 14001:1996 and the European standard EN ISO 14001:1996, establishing specification for environmental management systems;

- Decision No 2179/98/EC of the European Parliament and of the Council of 24 September 1998 on the review of the European Community programme of policy and action in relation to the environment and sustainable development 'Towards sustainability;'

- The IPPC Directive (EC/61/96) is being introduced across Europe to improve the standard of environmental protection. The purpose of the Directive is to achieve prevention and control of pollution arising from the range of specific activities.

There are a number of proposals for future environmental legislation within Europe, of which the key proposals are:

- Amended proposals for the Community eco-management and audit scheme;
- Proposals for minimum criteria for environmental inspections in member states.

These Directives will require being introduced into member states national legislation

1.3.3 Current and Proposed Health and Safety European Union Legislation

All member states are required to introduce national laws to implement the requirements of the Council Directive of 12 June 1989 on the introduction of measures to encourage improvements in the safety and health of workers at work, this is known as the Framework Directive (89/391/EEC). This Directive requires the member states to promote a steady improvement in working conditions, allowing them to be harmonised

while maintaining progress. These Directives, based on Article 118A of the Treaty of Rome, pursue this aim by laying down minimum requirements.

The Framework Directive obliges the employer to plan, organise, control, monitor and review health and safety arrangements; however, there is no legal basis that requires the adoption of specific formalised management systems.

There are some exceptions where specific EU Directives require management systems for specific industries or activities. For example, Annex III of the European Directive 96/82/EC on the Control of Major Accident Hazards Involving Dangerous Substances (the Seveso II Directive) requires certain specific major risk industries or activities to implement a safety management system. The safety management system of a high risk COMAH site, should include the organisational structure, responsibilities, practices, procedures, processes and resources for determining and implementing the major accident prevention policy.

1.3.4 Current and proposed Quality European Union legislation

There are no existing or proposed European legislative requirements for quality management systems.

1.4 Environmental Management Systems

1.4.1 Background and Development of Standards

Environmental audits had their origins in the USA during the 1970's. The development of environmental auditing systems and subsequent management systems was driven by compliance to environmental legislation and institutional requirements. In September 1993 one of the first national environmental standard was introduced by the UK: British Standard BS 7750: an Environmental Management System (BSI. 1993). This standard was seen as a model for subsequent developments and many of the key elements of this standard were incorporated into subsequent European (Eco-Management and Audit Scheme (EMAS)) and International (ISO 14001) standards. BS 7750 was superseded by ISO 14001 in September 1996.

1.4.2 Eco-Management and Audit Scheme (EMAS)

The requirement for environmental management systems within the European Union (EU) has its origins in the four European Community action programmes on the environment which have given rise to over 200 pieces of environmental legislation (EEA. 2000).

The "Eco-Management and Audit Scheme" (EMAS) is an example of the European Union's market based initiative designed to restore market forces in the environmental field by promoting competition on environmental grounds. The key aims of EMAS are to promote on-going improvements in the environmental performance of companies and the provision of environmental information to the public. It is site specific and only open to industrial sites. To participate in EMAS a company must:

1. Adopt an environmental policy;
2. Review environmental performance at the site in question;
3. Develop an environmental management system;

4. Develop a plan of action in light of the findings of the review, audit the system; and
5. Publish a statement of performance of the site.

The EMAS scheme is an accredited system that requires a qualified third party authorisation with site registration and regular audits.

The EMAS scheme's popularity has been hampered by its restriction to manufacturing sites and, to a degree, with the competition of the less demanding ISO 14001 environmental management standard which, for example, does not require a public statement of environmental performance. As of September 2000, The current number of European EMAS registered companies by member states is 2,970. (EC. 2000a)

During 1998 the European Commission consulted with EU member states, industry and environmental groups about the proposed revision to the EMAS regulation. These revisions were aimed at addressing the need for the EMAS scheme to compete on more favourable terms with ISO 14000. The main elements of the revised proposal are to extend the scope of EMAS to all sectors of economic activity including local authorities and the integration of ISO 14001 with EMAS.

Since 1998 these proposals have been considered by the European Council of Ministers, the European Parliament and the European Economic and Social Committee. The new EMAS Regulations were expected to enter into force in the second half of 2000. (EC. 2000a). However, as of October 2000 this has not yet occurred.

1.4.3 ISO 14001

Following the U.N. Conference on Environmental Development held during June 1992 in Brazil, the International Standards Organisation (ISO) made a commitment to support efforts for environmental development. During the 1990's, ISO Technical Committee 207 (ISO/TC 207) developed an International Environmental Management Systems Standard known collectively as the ISO 14000 series of standards, which comprises of one compliance standard ISO 14001 'Environmental Management Systems' and several guideline standards. The European Standards Body, CEN, adopted these ISO standards as European Standard on the 26 September 1996.

The latest ISO survey, completed in 2000, is the ninth survey and includes returns up to 31 December 1999. This ninth survey records the total number of certificates awarded worldwide in 84 countries, at the end of 1999 was 14,106 compared to 7,887 at the end of December 1998, showing a significant rise of 6,219 i.e. a 78 % increase. (1SO. 2000a)

The most recent development for ISO 14001 is the intention on the part of the ISO to achieve greater compatibility between the environmental management standard and the quality management standard ISO 9000, and to align the revision cycles. (Gelber. 1998)

In 1998 ISO issued a 'review' questionnaire to the ISO Environmental Management Committee (TC 207) on ISO 14001 and the related ISO 14004 guidelines. The findings were that the main elements of compatibility between ISO 14001 and ISO 9001 had been achieved. However, in view of the proposed revisions to the ISO 9000 quality management standard ("Year 2000" revision), the main conclusions of the committee were to accept the work towards revision already undertaken and authorise further work.

1.5 Health and Safety Management Systems

1.5.1 Background and Development of Standards

Unlike environmental standards, there has not been the same international pressure for organisations to introduce health and safety management systems. The exception to this has been from the publicly perceived "high risk" industries such as the nuclear and chemical industries. For example, the Seveso disaster in Italy in 1977 led to the need for the introduction of a formal health and safety management system for specific large scale processes mainly in the chemicals industries through European Directives such as the Seveso Directive 82/501/CEE (SEVESO I).

Whilst several standards have been developed in the UK, at the European and International level there has yet to be an agreed approach.

1.5.2 HS(G) 65

One of the earliest formalised health and safety standards was published by the UK's regulatory body for health and safety at work, the Health and Safety Executive (HSE): HS (G) 65 'Successful Health and Safety Management'. This publication set out in general terms a formalised management system for health and safety. This publication did not in itself detail any one system but made reference to a similar approach adopted by the then BS 5750 Quality Management System. In October 1997 the HSE revised this publication and republished (HSE. 1997b

1.5.3 BS 8800

Following HS (G) 65, the British Standards Institution prepared a standard on occupational health and safety management: British Standard BS 8800: A Guide to Occupational Health and Safety Management Systems (BSI. 1996a). This standard, published in May 1996, was a non-certifiable standard. The guidelines to this standard were based upon three different approaches, namely:

- Approach one is based upon HSE guidance HS (G) 65 Successful Health and Safety Management;
- Approach two is based upon the BS EN ISO 14000 series Environmental Management Standard, and;
- Approach three is described in outline only and is based upon BS EN ISO 9001 series Quality Management Standard.

The success of BS 8800, which has been available since May 1996, is uncertain. It is not an accredited certification standard as no register of accredited companies exists, it is not possible to judge either the current or future level of uptake. The launch of this standard in May 1996 was relatively low key with BSI reporting that after the first ten weeks the total volume of sales of BS 8800 was 2,380 copies and that sales have been running at about 250 copies per week since then. BSI report that after the first four months the level of sales "as a rather slow start". (Cawkell. 1996)

The original decision to produce BS 8800 in the form of guidance rather than as a certificated standard has led to considerable confusion. A number of bodies such as the UK Accreditation Service (Brockway. 1998), BSI (Smith. 1997) and the Health and Safety Executive (Bell. 1998) have argued against this original decision of the BS 8800 committee to produce a non-certifiable standard.

Following a meeting in July 1999 the committee responsible for BS 8800, failed to agree upon whether or not to produce a certified management standard for safety and health. The group agreed however, to monitor the progress of the new commercial guidelines, OHSAS 18001/2.

A proposal to review BS 8800, in order to clarify its position and improve its linkages with the quality assurance and environmental standards currently in place, was also discussed. The current position of BS 8800 as a non-accredited standard is now in doubt and the end of 2000 expects a full review of this standard. (Smith. 1999)

1.5.4 OHSAS 18000

In April 1999 British Standards published OHSAS 18001, Occupational Health and Safety Management Systems – Specification (BSI. 1999). This standard does not replace BS 8800. It has been published, not by the standards making body of BSI, but by the quality assurance commercial body of BSI the Product Approval Specification (PAS). It is a certifiable standard, but it is not an accredited standard, and has been developed as stated in its forward:

> "in response to urgent customer demand for a recognisable occupational health and safety management scheme standard against which their management systems can be assessed and certified". (BSI. 1999)

In May 2000 BSI published OHSAS 18002, Occupational Health and Safety Management Systems – Guidelines for the implementation of OHSAS 18001 (BSI. 2000) to compliment the development of the certificated standard.

1.5.5 European and International Status

Attempts to develop either a European or International Occupational Health and Safety Management System (OHSMS) have been fraught with failure. In 1997 an international workshop discussed a proposal for ISO to develop an OHSMS. It was resolved that ISO should not develop an International OHSMS because it was considered that:

- There were unlikely to be real benefits;
- There are probable disadvantages since it is 'early days' for ISO 14000;
- Any work should involve the International Labour Organisation (ILO) as a tripartite representative body.

Following ISO's rejection of this proposal, Spain proposed that Europe, through CEN, should develop a European rather than a worldwide certified occupational health and safety management standard. A meeting took place in 1997 of the CEN committee's national representatives who again rejected this proposal.

The International Labour Organisation (ILO) then took up the challenge to develop an OHSMS. They identified that this proposal should:

1. Be developed in consultation with the International Organisation for Standardization (ISO);
2. Be expressed in terms of a "standard" against which employers can assess their own performance; and
3. Offer the opportunity to employers who implement the OHSMS, to obtain internationally recognised independent verification of their achievements.

(ILO. 1999)

The key requirement was for the standard to be developed in consultation with (ISO). Therefore in May 2000 ISO reviewed their original decision not to prepare such a standard. In preparation for this review, a working party of ISO was requested to prepare a draft occupational health and safety code of practice for consideration. BSI proposed that ISO establish a technical committee to transform BS 8800, the British

OH&S management system guidelines, into an ISO standard. This proposal was rejected after a ballot of the ISO members.

Following this negative vote, ISO also decided that it would be not be appropriate to pursue an ILO offer for ISO to collaborate on the latter's own project to develop a standard on OHSMS. Therefore, ISO will undertake no further work to develop and introduce an international occupational health and safety management standard in the foreseeable future. (ISO. 2000b).

The ILO is continuing with its proposals to develop an OHSMS. However, without the collaboration of ISO the proposed occupational health and safety management standards future is uncertain.

Despite the rejection of a proposal for Europe to develop an OHSMS, the European Commission Directorate General Five (DG V) has established an ad hoc group to further consider a voluntary occupational health and safety standard or guideline. A conference was held during March 1999 in Dortmund and a working group was established to prepare a draft standard with DG V providing the secretariat. (Lommel. 1999).

The aim of this working group is to prepare an occupational health and safety management standard based upon existing European models. To establish exactly what type and number of occupational health and safety management standards are currently available, the European Agency for Safety and Health at Work (EAHSW) has commissioned a research project. The aim of this research project is to produce a status report with regard to the use of occupational health and safety management systems and to identify future areas of research in this topic. This research will be published in January 2001 (EASHW. 2000).

Whilst a number of attempts have been and are being made to develop a European and/or worldwide OHSMS, no significant progress has been made.

1.6 Quality Management Systems

1.6.1 Background and Development of Standard

After the Second World War pressure for conformity, reproducibility and standardisation came from the military. As a result, the 05 series of Ministry of Defence (MoD) quality standards and the Allied Quality Assurance Publication (AQAP) series of NATO standards were developed. Major companies in the automotive industry also began to establish their own quality system standards and assess their suppliers. In order to control the increase of different types of quality system standards and to reduce the multiple assessments, the British Standards Institution (BSI) eventually developed the military standards into BS 5750 series (Parts 1, 2 and 3: 1979). Since then, they have been used as the source for the ISO 9000 series. (Hakes. 1991)

1.6.2 ISO 9000 Series

In 1987, the ISO published a series of five international quality standards (ISO 9000, 9001, 9002, 9003, and 9004). This series, together with the terminology and definitions contained in ISO Standard 8402, provides guidance on the selection of an appropriate quality management program (system) for a supplier's operations.

As of the 31 December 1999, 343,643 ISO 9000 certificates had been awarded in 150 countries worldwide. This is an increase of 71,796 ISO 9000 certificates (26.4%) since the previous year, when the total stood at 271,847 for 141 countries. ISO reports that the worldwide picture shows a continuing growth in registration. (ISO.2000c)

The current ISO 9000 family contains some 27 standards and documents. This proliferation of standards has been of particular concern to ISO 9000 users and customers (ISO. 2000). Therefore, a major revision of the ISO 9000 series is currently being undertaken. This revision is known as the "Year 2000" revision. This revision process, which started in May 2000 and has involved a number of meetings and ballots of the technical details of this proposed revision by the various national standards representational organisations is planned to be published on the 15 December 2000.

The "Year 2000" revisions to the ISO 9000 family will consist of four primary standards supported by a considerably reduced number of other documents (guidance standards, brochures, technical reports, technical specifications). To the greatest extent possible, the key points in the current 27 documents will be integrated into the four primary standards, and individual sector needs will be addressed, while maintaining the generic nature of the standards. The proposed four primary standards are listed in table one-three.

Table 1- 3 The Proposed Four Primary Standards of ISO 9000 Year 2000 Revision.

ISO 9000:	Quality management systems – Fundamentals and Vocabulary
ISO 9001:	Quality management systems – Requirements
ISO 9004:	Quality management systems – Guidance for Performance Improvement
ISO 19011:	Guidelines on Quality and Environmental Auditing

The main features of the revised Quality Management Standards ISO 9001 and ISO 9004 are detailed in table one-four.

Table 1- 4 The Main Features of the Revised Quality Management Standards (BSI.1999)

Structure	The revision of the ISO quality management standards includes a significant change to the structure of ISO 9001 and ISO 9004, which, while retaining the essence of the original requirements, will reposition the 20 elements of the current ISO 9001:1994 and the guidelines of ISO 9004-1:1994 into four main sections: - Management responsibility - Resource management - Product realization - Measurement, analysis and improvement
Sequence	There is a more logical sequence of requirements and guidelines due to the process orientation of the new standards.
Top Management	More emphasis has been placed on the role of top management, which includes its commitment to the development and improvement of the quality management system, with a customer focus, consideration of legal and regulatory requirements, and establishment of measurable objectives at relevant functions and levels.
Continual Improvement	An enhanced requirement for "continual improvement" has been introduced, as anticipated, into ISO 9001, defining a complete cycle to improve the effectiveness of the quality management system.
Permissible Exclusions	The concept of "permissible exclusions" to the requirements of ISO 9001:2000 has been introduced as a way to cope with the wide spectrum of organisations and activities that will be using the new standard.
Customer Satisfaction	Another new item that has been introduced into ISO 9001:2000 is the requirement for the organisation to monitor information on customer satisfaction and/or dissatisfaction as a measure of system performance.
Resources	Attention has been placed on top management to provide and make available the necessary resources. Requirements now include evaluation of the effectiveness of training, provision of relevant information, internal and external communication, facility needs, and human and physical factors of the work environment
Terminology	Changes have also occurred in terminology. The most important changes concern the use of the term "organisation" instead of "supplier", still used in the current standards, and the use of the term "supplier" instead of "subcontractor". These changes respond to the need of being more consistent and friendly with the normal use and meaning of the words.
Documentation	The number of requirements for documented procedures has been reduced in ISO 9001:2000, and the emphasis placed on the organisation demonstrating effective operation.
Compatibility with ISO 14001	Additional alignment with ISO 14001 has been achieved. Informative annexes on correspondence between the clauses of the standards have been introduced.
Other changes	Other detailed changes of a less strategic nature are also being studied, wherever possible with the intention to simplify or clarify requirements of the existing standards, and to make them more "user-friendly".

1.7 Supporting Tools

Each of the management standards described in table one-one provide the skeleton of the management system. To implement these systems, detailed mechanisms are required. The main mechanisms or tools of implementation are considered to be significance review, risk assessment and audit. The concept of these tools has developed separately within the various management standards. Chapter two will further examine the literature regarding the effectiveness of these separate mechanisms and examine the possibilities of integration of these mechanisms.

1.8 Chapter Summary

Chapter one has detailed the background and development of environmental, quality and health and safety management standards. There are no current national/international integrated environmental, quality and health and safety management standards.

Chapter two examines the current position of both these separate standards and possibilities of integration of some or all of these standards.

Chapter 2.0 Literature Review

2.1 Introduction

Chapter two addresses research questions one and three, contained in chapter one, table one-two:

Question one:	*'Establish the current status use and application of individual management systems and standards'*
Question three:	*'Explore the concept of integrated management standards within organisations'*

This chapter explores the approaches and practices that have been developed towards the application of individual management standards and their integration. Specifically the research examines the current trends and opinions regarding:

- The current status and application of individual standards;
- Definitions of integration including culture and implementation levels;
- Trends towards integration of these standards; and
- Development of practical integration techniques such as significance review, risks assessment and audit.

2.2 Review of Individual Management Standards

2.2.1 Quality Standards

There is a continuing growth in certification to ISO 9000 as described in chapter 1.6.2. However, research undertaken (Subba-Rao. 1997 and Corbett. 2000) identifies that there are significant differences in quality performance between the organisations which are registered and those that are not. These findings support the view that ISO 9000 registration directly improves quality management practices in an organisation.

There is a counter view to this argument, which has been expressed in particular by the Directorate-General of the European Commission, who has questioned the effectiveness of ISO 9000 for infusing quality into European organisations (Stratton, 1994; Zuckerman, 1994). The Directorate-General's view was that ISO 9000 series of standards does not improve quality management practices in organisations. He identifies many examples where organisations perceive the need for an ISO 9000 certificate as an end in itself, rather than as a tool for total quality. The certification process does not deal with other important aspects of total quality management (TQM) practices like leadership, strategic planning or employee empowerment (Englewood and Prentice-Hall, 1992). Hence doubts have been expressed in practitioner literature (most of the ISO
9000 literature is practitioner oriented and anecdotal in nature) as to the effectiveness of ISO 9000 registration in implementing quality management practices and in improving quality. Whether, in fact, such is the case has not been empirically derived or tested on a large sample basis.

2.2.2 Environment

As with the growth in quality management standards, detailed in chapter 1.4, there has been a similar growth in the number of registrations with environmental management systems such as EMAS and ISO 14000. The Institute of Environmental Management (IEMA. 1998) identified the reasons for registering with such schemes as:

- Cost savings and improved management control
  Compliance with the standard would help to highlight potential cost savings such as waste minimisation.

- Meeting customer expectations
  Compliance to a standard would pre-empt customer expectations, develop new marketing opportunities and improve customer relations by reinforcing customer confidence.

- Demonstration of commitment
  Compliance with the standard would provide enhanced credibility from the independent certification, leading to better public relations and improved image with stakeholders.

- Improved environmental performance
  Compliance with the standard would potentially lead to fewer environmental incidents and reduced environmental impacts.

- Staying ahead of legislation
  This will help to demonstrate conformance with consents and better relationships with the regulators.

- Motivate the organisation towards environmental management
  Compliance with the standard should ensure commitment from the top and galvanise support for environmental management at all levels.

The reasons for the continuing growth in registration of environmental systems has been researched by a number of organisations, particularly working group eighteen of the International Standards Organisation. Table two-one (ISO. 1998) summarises the advantages and disadvantages.

Table 2- 1 ILO Summary of the Advantages/Disadvantages of Management Systems

Advantages	**Disadvantages**
External demonstration of the 'quality' of the organisation	No assistance in solving practical problems at plant level
Requirement to 'trade' with others	Not helpful for small companies
Insurers requirement to be able to produce detailed process and procedures for each aspect of operations	Huge costs associated with certification (e.g. total of two to three hundred thousand Deutchmarks for Siemens every year)
Assist organisations to business excellence	Those companies that have demonstrated success have done so through commitment and core value and not because of any management system
Certification can give a competitive advantage in a global market, especially as more countries adopt ISO standards	Expensive specialists needs
Organisations need a degree of standardisation to help identify best practice and to ensure they are working to common aims and standards	Doubtful that the cost could be justified by increased benefits
	Variation in certification requirements between certifying bodies

The potential disadvantages, listed in table two-one do not, on initial examination, explain the continuing growth in these systems, as these disadvantages appear to be not insignificant. The UK's Institute of Environmental Management and Audit (IEMA. 2000) have identified a reason for the continuing popularity of these standards. They believe that the standard provides a model for continuous improvement linked to the introduction of an environmental management system. This model is shown graphically in figure two-one. This model demonstrates how the introduction of a management system has improved performance from simple compliance management to continuous improvement.

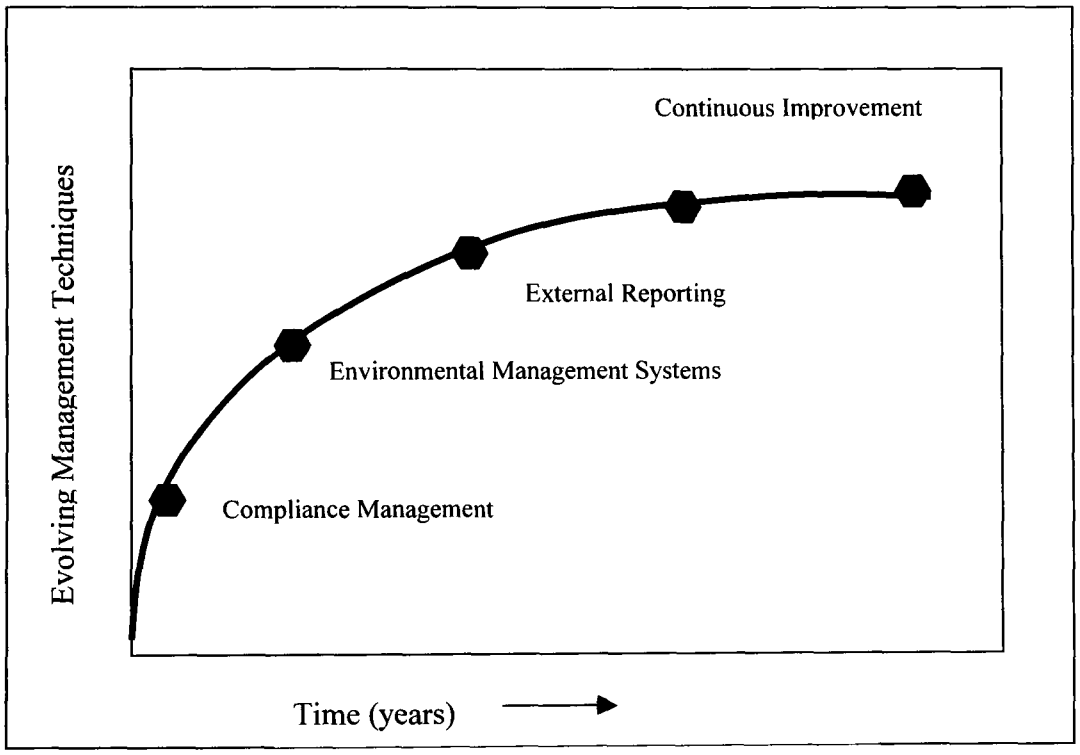


Figure 2- 1 IEMA Model for Continuous Improvement.

Another identifiable reason for the continuing growth in environmental standards registration is the need to demonstrate to the regulatory authorities effective environmental management, as part of the requirement to demonstrate conformance with consents. Registration to a third party accredited environmental system is often seen as an effective means of demonstrating this. This view is shared by the UK's government environmental regulatory authority, the Environment Agency (EA) which is introducing (October 2000) a trial to reduce the regulatory oversight of companies with formalised environmental management standards (Environmental Data Services. 2000).

2.2.3 Health and Safety

Analysis by Booth and Hawkins (1998) of the then two main UK standards:

- HS (G) 65: Successful Health and Safety Management; and
- BS 8800: Guide to Occupational Health and Safety Management Systems,

indicated that the effectiveness of the guide might be impaired by a failure to apply fully the key findings of core management literature. This research also suggested that the sequence of elements in the Health and Safety Executive's (HSG 65) model of successful safety management does not fully align with core theory and that the difference is more than a semantic distinction.

The Occupational Safety and Health Branch of the International Labour Office conducted an analysis of the nature and content of 24 occupational health and safety management standards from 15 countries. The report concluded that whilst the standards analysed were generally strong in addressing traditional occupational health and safety management issues such as risk assessment, hazard evaluation and control, and training. There was a general weakness in areas such as management commitment, allocation of resources, continual improvement, integration with other systems and management processes of organisation and management review (ILO. 1999)

The ILO concluded that the Spanish standard provided the most comprehensive audit arrangements. They also commended the British and Irish health and safety management standards as containing generally strong management issues, such as hazard control, training, evaluation, and risk/hazard assessment.

The ILO review identified a general weakness throughout the models including management commitment, resource allocation, continual improvement, integration with other organisational systems, and management review.

Because there are no formal International or European health and safety standards to use as a common standard to use as a basis to integrate with.This may explain why there

is limited research with regard to the advantages and/or disadvantages of introducing such national health and safety management standards to organisations.

As OHSAS 18001/2 is similar in its approach to the environmental management standard ISO 14000 it is considered that the advantages and/or disadvantages identified for this environmental standard will be similar to that of OHSAS 18001/2. However, the lack of an International or European standard, together with the general weakness identified by the ILO, particularly the need to integrate are, in the authors view, a major limitation to the successful uptake of any one national standard.

2.3 Integration of Management Systems

2.3.1 Introduction

Since the mid 1990's there has been much discussion of the possibilities of integrating management standards. Before this research reviews the current position regarding integration, it is necessary to recognise that organisations are not uniform. They will have different styles of management and different organisational cultures. Additionally, organisations are often not consistent between the various layers of management. Different styles and attitudes will develop at each layer of the management organisation. Also organisations do not stay static; they will be continuously changing, because of such factors as market forces, external factors and personalities so that the management system will be in an almost constant state of change reflecting these factors.

These factors will influence the effectiveness of the implementation of an integrated management system. A literature review of the key factors of structure, change, stratification and culture of an organisation has been undertaken below to determine their influence upon the introduction of an integrated management system to an organisation.

2.3.2 Definition of Integration

Whenever integration is proposed or discussed, it is necessary to establish exactly what is meant by the term 'integration' because different understanding of the extent of integration leads to confusion and difficulties. The dictionary definition of integration is "The act or process of making whole or entire." In practice, this research identified that there was not a seamless implementation of a management system at all levels of an organisation. As integration may vary with the different structures of organisations and with different cultures, it is necessary to review these structures and organisational cultures.

2.3.3 Structures of Organisations

A number of studies have examined the different management structures of organisations and have identified structures which were considered to be more effective

for the implementation of either quality or environmental management systems. In particular these studies noted:

Borri and Boccaletti (1995) identified from a study of the implementation of environmental management systems that there were three different management models:

(1) The passive model is characteristic to those industries that resist change and consider the environmental issues only as a cost, overlooking the possibility of new opportunities.

(2) The active model is characteristic to those industries that work just to comply with the regulations.

(3) The proactive model is characteristic to those industries which have embedded their environmental objectives at all levels of the hierarchy – from top to bottom –thus widening their competencies and responsibilities and changing their mission accordingly.

Moreno-Luzón and Peris (1998) identified from a study of the implementation of quality management systems that there were four different management models:

(1) Design school or conceptual strategy design

This model requires that strategy should be the expression of a conscious and deliberate form of management. This allows the formulation of a strategy that is explicit at a conceptual level, flexible and without formal planning, which marks the difference with:

- formal strategic planning;
- the intuitive vision of the previous approach; and
- emergent strategies.

(2) Strategic planning school

This approach has as its main characteristic, the building of a complete and logical articulated sequence for formulating the strategic plan, which improves the managerial techniques of long-term budgeting, financial control and long-term planning.

(3) Learning school

This approach emphasises the importance of the continuous process of learning and acquiring knowledge. Here emphasis is placed upon the intimate knowledge of the different dimensions of a business, and on the processes that modify managerial and operative skills and capabilities, giving rise to new situations and to changing needs in how the company should be managed.

(4) Strategic architecture

This approach establishes a framework of long-term planning with respect to what a company aims to achieve. A company tries to achieve the development of core competencies. These competencies are basic abilities that will allow it to obtain core products which, in turn, will lead to obtaining the products that are competitive in the industrial sectors of the future.

2.3.4 Organisational Change

Organisational structures rarely remain constant and will change; this will have implications as to the optimum time for the introduction of a formalised management system.

Tushman et al, (1996) identified a model of organisational transformation where four key transition states are plotted against time and 'extent of organisational transformation". The evolutionary and revolutionary zones are separated by a line of radical de-stabilisation. Each state is joined by a continuum of organisational adaptation, which steepens as organisational learning increases. These forces keep the organisation 'on the edge of chaos' (Handy, 1989), particularly as it transforms itself

from state two to state three and beyond. The model shown in figure two-two, relates to the 'punctuated equilibrium paradigm' (Tushman and Romanelli, 1985; Romanelli and Tushman, 1994; Tushman and O'Reilly, 1996).

As organisations change with time because of internal and external factors, there may be an optimum stage for the introduction of a management system.

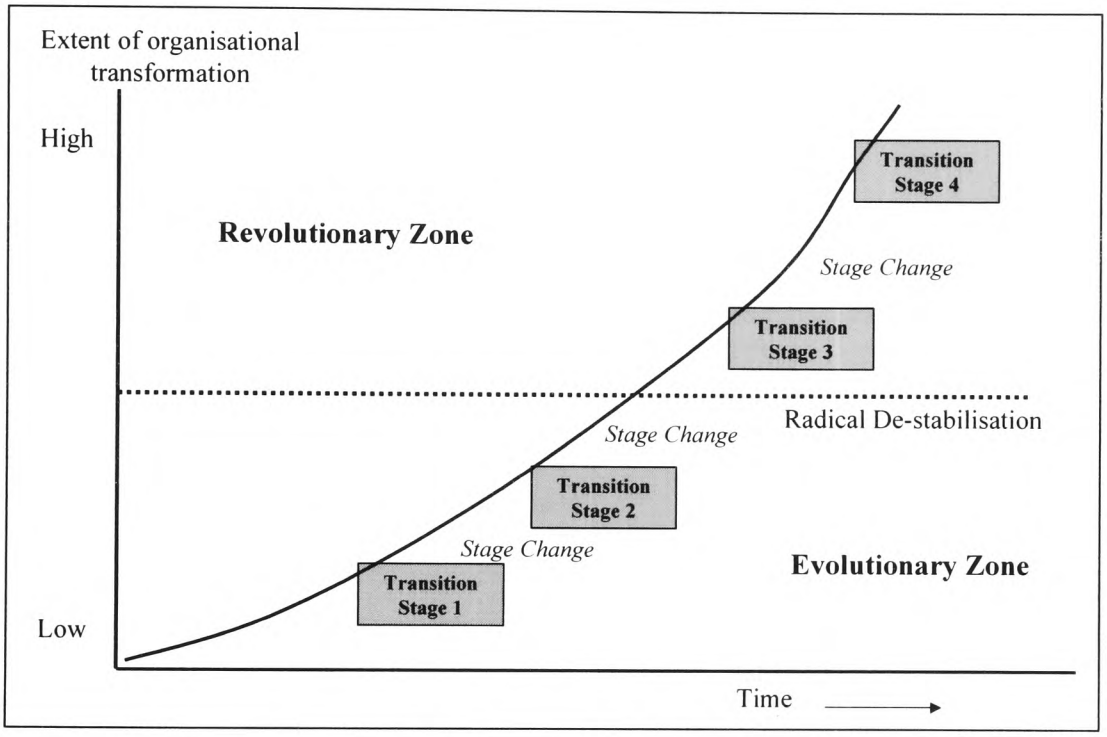


Figure 2- 2 The Tushman Model of Organisational Transformation

Transition State I

At this level of organisational transformation, the external environment is likely to be relatively stable and its rate of change manageable.

Transition State II

This stage reflects a more complex and less predictable external environment. There will be perceived competitive threats, which may be influenced to a greater extent by technological development. The vision must therefore be more long-term than that described in state I.

Transition State III

At this transformation stage, the environment is becoming complex and turbulent. Highly competitive markets are impacted on by rapid technological development. These external dynamics must be matched with internal flexibility. The organisational vision is therefore longer-term and evolving. In such uncertainty, it is important that this vision is shared across the various cultures within the organisation and inspires people to challenge the status quo.

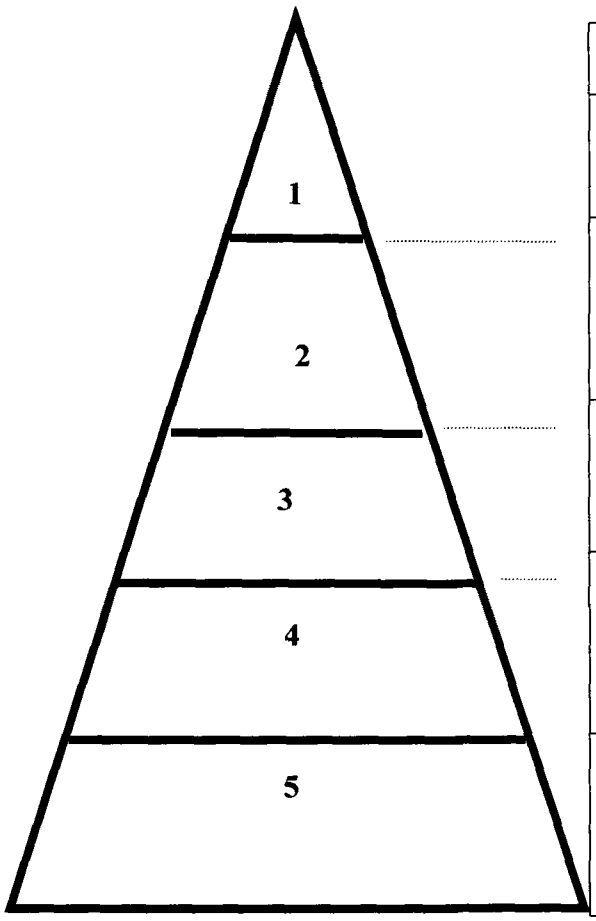
Transition State IV

Few organisations have reached this level of transformation so, as indicated above, state IV is semi-hypothetical.

The introduction of an environmental and/or health and safety management system will therefore be more effective if introduced between stages two and three.

2.3.5 Strata of a Management System

Whilst the literature has identified various management strategies, it has not identified the various layers within any one management system. This research identified that there were five main levels or components of a management system. These levels are shown in figure two-three. Each of these levels would be implemented by different members of an organisation, from the board and senior management implementing the strategic or policy level one, through to the shop floor employees implementing level four, the working instructions level. The use of these levels of a management standard, from the strategic level through to the operational and implementation levels, will assist in determining the definition of integration.



Title	Example
Level 1 Policy	The policy will set out the objectives and responsibilities to achieve the desired performance of the organisation.
Level 2 Operating	Level two sets out the detail of the management system and the arrangements across the organisation for such matters as approval of new suppliers of a raw material used in the manufacturing process.
Level 3 Process operation	Level three details how the management system will control a particular process such as the batch manufacturing of a drug.
Level 4 Working instructions	Level four specifies the operators detailed instructions on the particular task in the manufacturing process. The "Cookery Book".
Level 5 Results, forms and procedures	Level five specifies the process records from the working instructions and may include temperature and weights of additions from the batch manufacture process.

Figure 2- 3 The Levels of Implementation of a Management System within an Organisation

A fully integrated quality, health safety and environmental management system would have to be effective and beneficial at all five levels before this research can conclude that integration has been successfully achieved.

2.3.6 Culture

Almost without exception, the literature about general management asserts that culture has a significant effect on organisational performance (Lewis, 1998). Kotter and Heskett (1992) take a social anthropological approach and suggest culture represents the qualities of any specific human group that are passed from one generation to the next. Formally they define it as:

> "The totality of socially transmitted behaviour, patterns, arts, beliefs, institutions and other products of human work and thought characteristic of a community or population".

They propose that culture in organisations consist of two aspects. One aspect is the invisible, deeper and harder to change aspect associated with the shared values or beliefs that shape group behaviour and persist over time, even with changes in group membership. The second aspect involves group behavioural norms, which are more visible and easier to change. These are the common or pervasive ways of acting that are found in a group, and they persist because they are taught to new group members, because rewards flow to those that fit in and sanctions to those that do not.

Although researchers often describe organisational culture in the singular, all firms will have multiple cultures owing to different functional groupings or collectivities within the organisation.

Across the fields of quality, environment, health and safety management systems the role that the culture plays within organisations has been identified. A number of researchers have identified and described organisational cultures, for example:

2.3.6.1 Corbett and Rastrick

These researchers investigated the quality performance and management culture of a sample of New Zealand's manufacturing firms. (Corbett and Rastrick. 2000). This study identified that in general there were three main types of culture, namely:

1. Constructive styles

This group is usually associated with high levels of performance and low levels of stress within the organisational members.

2. Passive/defensive styles

The literature indicates that these styles represent cultures that generally have low levels of performance and employee well-being.

3. Aggressive/defensive styles

These styles represent cultures that perform tasks sufficiently well, but to the detriment of the people involved through creating high stress levels. These cultures generally encourage a steady reliability rather than outstanding levels of performance and innovation (Cooke and Rousseau, 1988).

2.3.6.2 Shillito

Shillito (1995) identifies that within any quality, environment or health and safety management system there are four main types of culture, namely:

1) The Rule Book or traditional 'Command' Culture

The basis of this approach is the belief that workers are mainly careless, in constant need of motivation and management discipline. This is the blame culture where supervisors enforce discipline ensuring that the workers do not deviate from the rules or procedures.

2) The Engineered Culture

The theme for this culture is that workers in industry and users of industrial products should be protected against all hazards, poor quality and environmental harm by the designs of engineers. It is the job of all engineers to eliminate all possible sources of harm, failure, poor health or loss of environmental quality. If they don't they are negligent and should be sued.

3) The Procedural Culture

The Procedural Culture treats the workers with more respect than the Rule Book Culture. It assumes that they are careless or forgetful, and in need of constant motivation. Motivation is made more palatable by rephrasing rules as `Policies', `Objectives' and `Targets.

4) The Behavioural Culture

This culture is based on the idea that workers are normal human beings who are motivated to work by many factors. They tend to be proud of achievements good design and quality and are concerned about the environment and want to work safely. Such reasonable people tend to create their own systems, which suits their needs.

Shillito concluded that the integration process could only be successful where all the disciplines are in the same culture. (Shillito. 1995). Corbett also identified the role of the company culture identified as a key factor in the integration of quality and environmental management systems in a study of New Zealand plastics industry (Corbett. 2000).

2.3.6.3 Health and Safety Executive

The HSE management model HS (G) 65 contains a specific reference to the need to create *'a positive health and safety culture'*. The HSE further identify that organisations need to produce a culture which promotes staff commitment to health and safety and emphasis that deviation from corporate safety goals, at whatever level, is not acceptable.

This literature review suggests that there is a link between culture and performance and that organisational culture will influence the quality, environmental or health and safety performance. The culture of the organisation will influence the feasibility of integration, as some organisational cultures will integrate better than others will. For example, constructive styles and/or a behavioural culture should integrate more effectively than others, because such cultures will support a consensus for commitment to introducing a new management system as opposed to the other command style, which will seek to impose such changes. If there are already different organisational cultures, for each separate standard, then as identified by Shillito, they will not easily integrate, until their culture basis is the same.

2.3.7 Summary of Previous Research

Previous research undertaken by the author (Newbury. 1997) examined:

1) The likely acceptance by organisations of occupational health and safety management standard, in light of the then newly introduced BS 8800;

2) By means of a questionnaire, the research determined that organisations wanted to introduce an integrated standard for health, safety, environment and quality (or some combination of these) rather than a separate health and safety management standard at that stage;

3) Developed a top level (Policy) integrated health, safety and environmental management standard, to support item two above and established that in principle, organisations wished to adopt such an integrated standard.

This research established that organisations were indicating that an integrated standard was required. However, no previous research had developed and tested such a detailed proposed integrated health, safety and environmental management standard, which included fully developed appendices containing arrangements for:

- Initial significance review
- Organisation
- Risk assessment
- Emergency preparedness
- Audit
- Documentation

The development and testing of such a fully developed standard, as described above, was to form the key aim of the research presented here.

2.4 Current Status of Integration of Management Systems

2.4.1 Integration of Quality and Environment

Following the development of separate BS EN ISO 14001 Environmental and BS EN ISO 90001 Quality Management Systems, the feasibility of integrating both standards is examined.

Comparison of ISO 9000 and ISO 14000

ISO 14001 uses the same fundamental systems as ISO 9000 for example, documentation control, management system auditing, operational control, control of records, management policies, audits, training, statistical techniques, and corrective and preventive action. These similarities are detailed in table two-two.

However, a comparison of the two standards also shows areas of differences; ISO 14001 has clearer statements about communication, competence and economics than ISO 9000. Also, ISO 14001 incorporates the setting of objectives and quantified targets, emergency preparedness, considering the view of interested parties and public disclosure of the environmental policy.

Table 2- 2 Correspondence between ISO 14001 and ISO 9001 (as specified in ISO 14001)

ISO 14001:1996		ISO 9001:1994	
General requirements	4.1	4.2.1	**General**
Environmental policy	4.2	4.1.1	**Quality policy**
Planning			
Environmental aspects	4.3.1	-	
Legal and other requirements	4.3.2	-	
Objectives and targets	4.3.3	-	
Environmental management programmes	4.3.4	4.2.3	Quality planning
Implementation			
Structure and responsibility	4.4.1	4.1.2	Organisation
Training awareness and competence	4.4.2	4.18	Training
Communications	4.4.3		
Environmental management system	4.4.4	4.2.1	General
Documentation	4.4.5	4.5	Document and data control
Document control	4.4.6	4.2.2	Quality system procedure
Operational control	4.4.6	4.3	Contract review
	4.4.6	4.4	Design control
	4.4.6	4.6	Purchase
	4.4.6	4.7	Control of customer supplied products
	4.4.6	4.9	Process control
	4.4.6	4.15	Handling, storage, packaging and delivery
	4.4.6	4.19	Servicing
	-	4.8	Product identification and tractability
Emergency response	4.4.7	-	
Checking and Corrective Action			
Monitoring and measuring	4.5.1	4.10	Inspection and testing
	-	4.12	Inspection and test status
	-	4.20	Statistical techniques
Monitoring and measuring	4.5.1	4.11	Control of inspection
Non-conformances	4.5.2	4.13	Control of non-conformances
Non-conformances	4.5.2	4.14	Corrective and preventative actions
Records	4.5.3	4.16	Control of quality records
Audit	4.5.4	4.17	Internal quality audits
Management review	4.6	4.1.3	Management review

International proposals towards integration

As a step towards the integration of quality and environmental management standards, ISO currently propose to develop a joint auditing standard. Work on this auditing standard, ISO 19011 has moved ahead and the target date for this draft standard is November 2000 for voting by member bodies of ISO and the final publication of the standard is targeted for the third quarter of 2001.

2.4.2 Integration of Occupational Health & Safety and Environment

BS 8800 Occupational Health and Safety Management Standard has a clear stated link to ISO 14000 Environmental Management Standard. This link was further established with the introduction in 1999 of OHSAS 18001, which specifies, in the forward to the standard, that OHSAS 18001 has been developed to be compatible with ISO 14001 in order to facilitate the integration of environment and health and safety management systems by organisations. These similarities are detailed in table two-three.

Table 2- 3 Correspondence between OHSAS 18001 and ISO 14001 (as specified in OHSAS 18001)

OHSAS 18001		**ISO 14001**	
4	Management system element	4	
4.1	General	4.1	General
4.2	Policy	4.2	Policy
4.3	Planning	4.3	Planning
4.3.1	Planning of hazard and risk identification and control	4.3.1	Aspects
4.3.2	Legal and other requirements	4.3.2	Legal and other requirements
4.3.3	Objectives and targets	4.3.3	Objectives and targets
4.3.4	Management programme	4.3.4	Management programme
4.4	Implementation and operation	4.4	Implementation and operation
4.4.1	Structure and responsibility	4.4.1	Structure and responsibility
4.4.2	Training awareness and competence	4.4.2	Training awareness and competence
4.4.3	Consultation and communication	4.4.3	Consultation and communication
4.4.4	Documentation	4.4.4	Documentation
4.4.5	Document and data control	4.4.5	Document control
4.4.6	Operational control	4.4.6	Operational control
4.4.7	Emergency preparedness and response	4.4.7	Emergency preparedness and response
4.5	Checking and corrective actions	4.5	Checking and corrective actions
4.5.1	Performance monitoring	4.5.1	Monitoring and measuring
4.5.2	Accidents incidents and non-conformances	4.5.2	Non-conformances
4.5.3	Records	4.5.3	Records
4.5.4	Audit	4.5.4	Audit
4.6	Review	4.6	Review

New legal developments increase the pressure for integration of health, safety and environment. To enforce the forthcoming COMAH regulations, within the UK, a new 'Competent Authority' which comprises the Health and Safety Executive (HSE), the Environment Agency for England and Wales and the Scottish Environment Protection Agency (SEPA) has been established. (HSE. 1999).

2.4.3 Integration of Quality, Environment, Occupational Health and Safety

Many organisations (Bacon. 1996, Asherson. 1998 & Barrell. 1999) have supported a comprehensive integration of quality, environment, occupational health and safety into one management standard. This is probably best illustrated by the UK's Institution of Occupational Safety and Health's (IOSH) policy statement on the integration of management systems for occupational safety and health, environmental performance and quality (the 'Integration Policy'). This committee's opinion and the policy of the institute is that:

> "On a superficial view, the case for integrating management systems (IMS) appears overwhelming: an IMS should lead to less duplication of effort, to the development of procedures that, for example, are optimally designed to take into account the needs of each discipline, and to the avoidance of a damaging compartmentalisation of expertise. Our considered view is that an IMS should be the preferred option for many, but not all, organisations". (IOSH. 1998)

However, Wilkinson & Dale (1998) surveyed five of the U.K. certification bodies who were responsible for over 75% of the certification of ISO 9000 and 14000. This survey examined their attitude towards integrated quality, environment, and health and safety management standards. This survey concluded that the interest in integration expressed by the certification bodies was limited and this apparent lack of interest may explain the recent ISO decision to take no further action in developing an occupational health and safety management system. The reason cited by the certification bodies was that integration was likely to increase costs without any commensurate improvement in standards.

Whilst many organisations support this view, there is little practical development in preparing a nationally or internationally recognised integrated health safety and environmental management system.

2.4.3.1 Independent Management Systems

A number of individual organisations have developed their own integrated HS&E management systems which share some common features, but are not transferable from one organisation to another. Examples of these schemes are:

South Africa

The BMW South Africa production facility World Plant 9 at Pretoria, South Africa, has achieved a world first for motor manufacturers and a first for BMW plants world-wide to be recently awarded ISO 9001, ISO 14001 and BS 8800 certification. (Ellen. 2000)

The Chemicals Industries Association have published their own guide entitled 'Responsible Care Management Systems for Health, Safety and the Environment.' This guide supports this combined approach of integrating both systems. The Health and Safety Executive, The Environment Agency, and the Institute of Chemical Engineers all support this guide. (CIA. 1995).

Astra Zeneca plc, a multi national pharmaceutical company, operates a safety, health and environmental (SHE) management system, which specifies the system requirements but not the detailed methodology. The integration of environment and health and safety only occurs at the top level (Zeneca. 1994).

3M's have introduced an 'integrated' management system of quality, environment, and health and safety at their plant in Wales. However, in practice, only quality and environment are linked so far. The company anticipates that health and safety will be introduced through the OHSAS 18001 model. This is not a fully integrated system: it is a parallel management system of quality and environment, each of which completely stands alone. The only integrated part is the development of the working instructions and operating procedures, which reflect both quality and environmental issues. However, significance review, audit functions and risk assessments are all completed separately and conducted by specialists. No one person would undertake audits of all of the three disciplines (Morris. 1999).

2.4.4 Advantages and Disadvantages of Integrated Management Systems

2.4.4.1 Quality, environment and occupational health and safety

Previous research (Newbury. 1997) identified fundamental differences between health, safety and environment to those of quality systems, namely:

- Health, safety and environmental standards are based on detailed, often legal, standards as opposed to quality systems, which are based on customer satisfaction rather than legal enforcement.

- Health, safety and environmental standards are concerned with human health and well being. Quality focuses on the end product specification.

- Health, safety and environmental standards potentially affect members of the public. Quality is fundamentally about customer satisfaction.

- The means of assessment and control of potential occupational health, safety and environmental issues can be the same and often technical means of control need to be considered together. For example, dust abatement plant installed in a factory to reduce workers exposure to process dust will also control dust releases to the atmosphere. Such additional technical controls may not be necessary to achieve quality control.

- Health, safety and environmental controls may oppose the quality of the product e.g. the use of water rather than solvent based paints to protect the worker and the environment, but providing a less durable finish to the product.

- In service based industries 'just-in-time-delivery' may, for example, provide quality advantages, but increase risks of road traffic accidents and environmental pollution.

Whilst it is technically feasible to integrate quality with environment and health and safety (Shillito. 1995 and Ramsey. 1998), the similarities between environment and

health and safety are greater than quality. Therefore, in the first instance, it is logical to link environment and health and safety together, with the aim of integrating quality at a later date.

There are supporters of such comprehensive quality, environmental, occupational health and safety management systems. For example, the Institution of Occupational Safety and Health (IOSH) identifies the following advantages:

- A well-planned integrated management system (IMS) is likely to operate more cost-effectively than separate systems, and facilitate decision-making that best reflects the overall needs of the organisation;
- The objectives and processes of management systems are essentially the same;
- Integration should lead to the avoidance of duplication, for example in personnel, meetings, computerised record-keeping software, audits and paperwork;
- Integration should reduce the possibility of resolving problems at the expense of creating new difficulties in other disciplines;
- An IMS should involve timely overall system reviews where momentum in one element of an IMS may drive forward other elements that might otherwise become moribund;
- Expertise in each discipline could be more readily brought together to address specific issues;
- An IMS should minimise distortions in resource allocations in separate systems;
- A positive culture in one function may usefully be carried over to the others.

Whilst this policy identifies some advantages, there is no specific linkage to quality, environment or health and safety. The issues identified are global and would apply to any management policy. This view does not attempt to identify the key differences in the three separate standards. Health, safety and environment are concerned with

minimum legal standards, whereas quality is concerned with customer acceptance, a fundamental difference, which is not identified by this IOSH policy.

Picard. (1998) identified that ISO 9000 quality control standards and ISO 14000 environmental standards shared much in common. However, Rezaee and Elam (2000) identified that combining both standards may not be without its challenges, as it will make the initial registration process more complicated. Environmental risks are very uncertain, and environmental outlays are significant.

Despite an expressed desire by many organisations for a comprehensive quality, environmental, occupational health and safety management standard (BSI. 1996b, Newbury. 1997), the author believes that the integration of occupational health and safety and environment into one management standard should be the first step. The long-term aim would then be to integrate quality into the environmental, health and safety management system.

2.4.4.2 Occupational health and safety and environment

The commonalties of both systems have been established previously, but the potential advantages and disadvantages of such integration are considered in table two-four.

Table 2- 4 Advantages and Disadvantages of an Integrated Health, Safety and Environment Management Standard.

Advantages	**Disadvantages**
Occupational health and safety and environmental systems are very similar in their concept of control, using similar methods such as policy statements, risk assessment and written systems of work	The existing systems may simply work well
Both occupational health and safety and environmental issues are controlled by detailed criminal regulations enforced by specialist inspectorates.	An IMS could become over centralised and over complex without the capacity to give sufficient consideration of local needs and constraints. Already many employers and employees are sceptical of the excessive bureaucracy of existing management systems
Both potentially affect members of the public	The models on which each management system is based may appear compatible, but there are conceptual differences that may be difficult to reconcile. e.g. the global environmental dimension as opposed to the local health safety dimension
The means of hazard and risk assessment and control are often the same and the technical means of control need to be considered together. e.g. dust abatement plant in a factory to reduce workers exposure to process dust will also have to control dust releases to the atmosphere	The time during which an organisation is planning and implementing an integrated system is a period of organisational vulnerability
Process working instructions can be written to consider both occupational health and safety and environmental issues	Regulators and single-topic auditors may have difficulty evaluating their part of the IMS when it is interwoven with other parts of no concern to the evaluator
Training and awareness programmes can incorporate occupational health and safety and environmental issues. e.g. the explanation of how to use a chemical safely with both its human and environmental risks and control measures considered	A powerful integrated team may reduce the ownership of the topics by line management
	A negative culture in one topic may unwittingly be carried over to the others.

Whilst there are identifiable disadvantages, these mainly focus around the cost and bureaucracy of such integration. The advantages contained within an integrated health, safety and environmental management system of continuous improvement leading to a competitive business edge, 'Do what you do better' should potentially outweigh the disadvantages, if continuous improvement can be achieved.

A review of the literature leads to the conclusion that whilst there are many advocates for the development of a comprehensive environmental and occupational health and safety management system; such as ISO Technical Committee TC 207 (Gelber. 1998) and the German Federal Ministry of Labour and Social Affairs (BMA .1997) there are few authors arguing against such integration.

Whilst there is support for the development of an environmental, health and safety management standard this, in itself, will only provide the skeleton of the management system. To develop the system detailed mechanisms of the means of implementation are required. These mechanisms are required to implement the integrated management standard at levels two to five as illustrated in figure two-three. These mechanisms of the means of implementation will include:

- Significance review
- Risk assessment
- Audit
- Communications
- Planning
- Training
- Emergency procedures

The main mechanisms are considered to be significance review, risk assessment and audit. The current position of these three topics is considered below.

2.5 Significance Review

2.5.1 Introduction

The purpose of a significance review in any management system is to:

1. Determine the current levels of performance of the company against agreed minimum standards; and
2. Compare the relative potential loss from one topic to another in order to prioritise risk management.

The concept of a significance review has developed separately within the various management standards. The principle of a significance review has been developed in the fields of health and safety and environmental management systems as described below.

2.5.2 Environmental Significance Review

Both the two main European and International standards contain a detailed requirement for a significance review, specifically:

EMAS

With the introduction of Eco Management and Audit Scheme there was a clear requirement for a significance review given by:

> Article 3
> Participation in the scheme which requires that in order for a site to be registered in the scheme the company must:
>
> (b) conduct an environmental review of the site on the aspects referred to in Annex I, part C.

The definition contained in EMAS Annex I, Part C is that an environmental review shall mean an initial comprehensive analysis of the environmental issues, impact and performance related to activities at a site.

ISO 14000

There was also a requirement for a significance review with the introduction of ISO 14000 series A.3 Planning, A.3.1 Environmental aspects. The supporting annex to this standard gives additional information as to the requirements and is intended to avoid misinterpretation of the specification.

ISO 14000 sub clause 4.3.1 is intended to provide a process for an organisation to identify significant environmental aspects that should be addressed as a priority by the organisation's environmental management system. This clause specifies that this process should take into account the cost and time of undertaking the analysis and the availability of reliable data. Information already developed for regulatory or other purposes may be used in this process. Organisations may also take into account the degree of practical control they may have over the environmental aspects being considered. Organisations should determine what their environmental aspects are, taking into account the inputs and outputs associated with their current and relevant past activities, products and/or services.

An organisation with no existing environmental management system should, initially, establish its current position with regard to the environment by means of a review. The aim should be to consider all environmental aspects of the organisation as a basis for establishing the environmental management system.
The review should cover four key areas:

a) Legislative and regulatory requirements;
b) Identification of significant environmental aspects;
c) Examination of all existing environmental management practices and procedures;
d) Evaluation of feedback from the investigation of previous incidents.

In all cases, consideration should be given to normal and abnormal operations within the organisation, and to potential emergency conditions.

2.5.3 Health and Safety Significance Review

Unlike environment, there are no international standards for health and safety management systems. However, the major worldwide occupational health and safety management standards listed in chapter one, table one-one all have a requirement for some form of significance review or baseline audit to establish the organisation's initial health and safety performance.

The ILO evaluated the standards listed in chapter two, table one-one. One of the key performance indicators the ILO used was "Did the evaluated standards contain a requirement for a baseline evaluation or review of the organization's existing OHS management practices?" Of the sixteen standards reviewed only the Polish standard did not contain a requirement for a significance review. (ILO. 1999)

2.6 Risk Assessment

2.6.1 Introduction

Dr Ron Haigh the then head of Industrial Hygiene and Medicine Unit Directorate General Five of the European Communities Commission, identified that:

> "The world is a risky place in which to live! The world tolerates that 750,000 deaths occur on the roads each year. Pollution from the use of fossil fuels creates incalculable loss to the world's environment and to the health of its inhabitants. The misuse of chemicals provokes suffering and deformity. In the European Community alone, over 21 million tonnes of toxic waste have to be treated each year." (Haigh. 1992a)

The responsibility to control health, safety and environmental risks lies with those that created the risks in the first place. Since the early 1970s organisations have been required to demonstrate to all stakeholders, that risks are adequately controlled and have developed various risk assessment methodologies to demonstrate this.

Initially such methodologies were developed by bodies such as the insurance industry and by the major hazards industries typically the oil and gas, nuclear and chemical manufacturing to support planning applications and associated public enquires.

Additionally, a number of major disasters and subsequent inquiries, such as Seveso in Italy, led to legislation being introduced in many countries. This legislation required risk assessment techniques by all manufacturing processes to demonstrate that these organisations have control of the process and there are no unacceptable risks to workers health and safety or to the environment.

The HSE (1997) undertook research as to the tolerability of risk from nuclear power stations. This research identified that the concept of risk assessment also embodies issues such as:

- Tolerability of risk;
- Acceptability of risk;
- Public perception;
- Quantification; and
- Prioritisation of outcomes.

Each of the above factors has to be encompassed in any risk assessment model. Section 2.9.4 will review these elements and examine the current research to develop integrated risk assessment methodologies.

2.6.2 Definitions

Useful and well established definitions of hazard and risk for the purposes of risk assessment are contained within the EU Commission Directive 93/67/EEC:

Hazard

A source or a situation with a potential for harm in terms of human injury or ill-health, damage to property, damage to the environment, or a combination of these.

Risk

The combination of the likelihood and consequence of a specified hazardous event occurring. The purpose of risk assessment is to determine:

- Whether the risk is so great or the outcome so unacceptable that it must be refused altogether,

- Whether the risk is, or can be made so small that no further precautions is necessary,

- If the risk falls between these states, then it has been reduced to a level which is 'tolerable'

This leads to a definition of the risk assessment process as:

Risk assessment

The overall process of estimating the magnitude of risk and deciding whether or not the risk is tolerable or acceptable. This process includes both risk estimation and risk evaluation.

There has been separate development of environmental and health and safety risk assessment methodologies.

2.6.3 Environmental Risk Assessment

Internationally, the introduction of the world wide EN ISO 14001 Environmental Management Systems Specification with guidance for use which contains a requirement for risk assessment:

EN ISO 14001 Section 4.3 Planning

Environmental aspects

> "The organisation shall establish and maintain procedure(s) to identify the environmental aspects of its activities products or services that it can control and over which it can be expected to have an influence in order to determine those which have or can have significant impacts on the environment. The organisation shall ensure that the aspects related to these significant impacts are considered in setting its environmental objectives."

The supporting Annex of this standard expands these requirements recommending a strategy of a significance review and environmental risk assessment. However, this annex does not contain detailed methodology of how to conduct an environmental risk assessment.

Fedra, Winkelbauer et al (1991) reviewed the environmental assessment techniques available and described the core requirements which are best illustrated in the UK's Department of Environment guide to environmental risk assessment (DE. 1990a) which sets out both the principles and detail of the methodology of environmental risk assessment. This methodology has five stages and is shown in table two-five.

Table 2- 5 The Five Stages of Environmental Risk Assessment

Stage	Title
1	Description of intent
2	Hazard identification
3	Identification of consequences
4	Estimate of the magnitude of consequences
5	Estimate of the probability of consequences

A simple matrix given in table two-six is used to quantify the outcome of this process in terms of the overall potential for harm to the environment including man, the eco-system and the non-living environment.

Table 2- 6 Matrix of Environmental Significance.

	Consequences			
	Severe	Moderate	Mild	Negligible
Probability				
High	High	High	Medium/low	Near zero
Medium	High	Medium	low	Near zero
Low	High/Medium	Medium/low	low	Near zero
Negligible	High/Medium/ low	Medium/low	low	Near zero

This methodology is acknowledged as a gross oversimplification because it:

- Estimates "raw risk" i.e. the risk without the control measures in place to prevent its consequences;
- Measures loss not only to man but to the eco-system including geographical, climate based or use based;
- Measures loss not only to man but also to the non living environment such as building damage associated with acid rain; and
- Considers combined hazards in one assessment.

This guide was updated by the Department of the Environment, Transport and the Regions (DETR) with the introduction of guidance to address the environmental risk assessment requirements (DETR. 1999) of the Control of Major Accident Hazards (COMAH) Regulations. These regulations brought into force the requirements of Council Directive 96/82/EC on the control of major accident hazards involving dangerous substances ('the COMAH Directive'). This guidance identifies that the risk assessment process can be viewed as addressing seven basic questions:

1. **What Can Go Wrong?** i.e. identification of the sources of potential accidents and the ways they could happen (hazard identification);
2. **How Often?** i.e. an estimate of the probability of their occurrence (source frequency);
3. **What Gets Out and How Much?** i.e. evaluation of the size of the release from knowledge of the material(s) in question and release rate calculations;
4. **Where does it get to?** i.e. dispersion (and deposition) predictions for the release;
5. **What are the Consequences?** i.e. an estimate of the potential consequences of the accidents (consequence assessment);
6. **What are the Risks?** i.e. determination of risk levels derived from the above analyses, and assessment of their significance; and
7. **So What?** i.e. risk management action.

However, this guide does not propose a specific methodology to undertake environmental risk assessment. It suggests that the following methods should be considered:

- Failure Modes and Effects Analysis (FMEA).
- Hazard and Operability Study (HAZOP).
- Frequency Assessment
- Consequence Assessment

These methods are outlined in section 2.7.3 and have their origins in health and safety risk assessment. This lack of a clear methodology is considered to be a significant limitation of this guidance and of the department's policy.

2.7 Health and Safety Risk Assessment

2.7.1 Methods

A review of the methods of health and safety risk assessment show that the techniques can be broadly categorised into three main types:

Qualitative risk assessment is the comprehensive identification and description of hazards from a specified activity, to people or the environment. The range of possible events may be represented by broad categories, with classification of the likelihood and consequences, to facilitate their comparison and the identification of priorities.

Semi-quantitative risk assessment is the systematic identification and analysis of hazards from a specified activity, and their representation by means of both qualitative and quantitative descriptions of the frequency and extent of the consequences, to people or the environment. The importance of the results is judged by comparing them with specific examples, standards or results from elsewhere.

Quantitative risk assessment is the application of methodology to produce a numerical representation of the frequency and extent of a specified level of exposure or harm, to specified people or the environment, from a specified activity. This will facilitate comparison of the results with specified criteria. (EA. 1999)

2.7.2 Qualitative Risk Assessment

These methodologies are all similar in approach in that they will carry out the assessment process in a number of stages as detailed below in table two-seven.

Table 2- 7 The Stages of Risk Assessment

Stage	Action
1	Define hazard and then risk
2	Define those at risk
3	Define the level of risk
4	Identify existing control measures
5	Identify relevant standards
6	Compare 4 against 5
7	Identify any shortfalls at stage 6
8	Develop action plan
9	Record

Within the UK, methods have primarily been developed by insurance companies to analysis business risk to themselves. These methods followed the steps shown in table two-seven but assessed step three, the levels of risk, in terms of their own financial exposure, as the under-writers of this risk.

The initial users of risk assessment methods were from the chemicals and nuclear industries. These methods are mainly quantitative not qualitative and were developed in response to planning applications and public enquires.

The HSE have produced a number of documents on risk assessment of which the key publication is considered to be 5 steps to risk assessment (HSE. 1994).

This document produced to support the Management of Health and Safety at Work Regulations (HSC. 1992 and 1999), details five steps to risk assessment. These steps are defined by the publication and shown in table two-eight.

Table 2- 8 The HSE Five Steps to Risk Assessment Approach

Step	Action
1	Look for the Hazard
2	Decide who might be harmed and how
3	Evaluate the risks arising from the hazards and decide whether the existing precautions are adequate or more should be done
4	Record your findings
5	Review your assessment from time to time and revise it if necessary

Whilst this document was widely circulated and distributed free by the HSE and gives guidance on the risk assessment principles, it has oversimplified the process by:

- Not clearly distinguishing between hazard and risk;
- Not clearly indicating the role of published standards in the assessment process;
- Not highlighting the need for corrective actions where identified; and
- Concentrating upon the record keeping element.

2.7.3 Quantitative Risk Assessment

A number of formalised methods for calculating risk assessment have been developed to analyse the possibility and likelihood of the incident occurring and the severity of the consequences. Such techniques include:

Fault Tree Analysis (FTA)

FTA provides a systematic approach to the identification of the combinations of possible occurrences that could combine to produce an undesirable effect. The possible combinations of occurrences once identified are displayed graphically in a fault tree. The frequency or probability of these occurrences can be estimated to enable a quantitative analysis of the undesirable effect to be conducted. FTA can be useful in identifying a list of potential failures.

Hazard and Operability Studies (HAZOP)/ Hazard Analysis (HAZAN)

HAZOP is a procedural tool designed to highlight the deficiency and shortcomings in the design and operation of industrial plants. HAZOP studies aim to identify hazards and operability problems in plants, which if they were to occur, could reduce the plant's ability to achieve target productivity in a safe manner. It was initially developed by Imperial Chemical Industries (ICI) Ltd for improving the safety of their chemical plants. The procedure proved to be so successful that it gained wide acceptance within industry as a useful tool for quantitative hazard analysis. The technique is now widely used as a standard procedure for safety assessment in the process, chemical, petroleum industries and many others.

HAZAN is a selective technique arising from a HAZOP where the probability of an accident and the extent of the consequences are calculated and compared with a target criterion. This technique shows how the hazard arises, which contributing factors are the most important and which are the most effective ways of reducing the risk. This technique is dependent upon the availability of accurate data on the reliability of mechanical components such as failure rates of valves and seals.

Failure Modes and Effects Analysis (FMEA)

FMEA is a quantitative structured method for hazard identification. FMEA is a preliminary failure analysis methodology, and as such it is widely used in a multitude of applications related to safety, reliability, processes and product design and development and quality of products and systems.

Event Tree Analysis (ETA)

ETA is one of the logic tree methods for hazard identification. Event tree analysis works from the event backwards. Event trees provide a method of recording the accident sequences and defining the relationships between the initiating events and the subsequent events that combine to result in an accident. Then by ranking the accidents, or through a subsequent quantitative evaluation, the most important accidents are identified. Each branch of the event tree represents a separate effect that is a clearly defined set of functional relationships (IChemE. 1999).

2.7.4 Considerations of Risk Assessment

Risk assessment has common overlaps in many subject areas including health, safety and environment specifically:

1. Quantification
2. Tolerability of risk including public perception
3. Prioritisation of outcomes

These common issues are addressed below.

Quantification of Risk

Quantified risk assessment (QRA) is a technique first developed by the Royal Society, (Royal Society. 1983) to broadly predict the frequencies and consequences of accidents which have the potential to cause human injury off-site. QRA will take into account the following factors:

- Quantification of likely risk with an understanding of the inherent uncertainties in this (essentially technical);
- Reference to the benefits generated by the project and the political and economic considerations associated with it;
- Weighing of what might be judged tolerable or intolerable by the public, taking all these considerations into account; and possibly
- A decision as to how far further reduction of risk could reasonably be attempted, taking cost into account.

Quantification of the results of a major event is expressed in terms of societal risk. This is a concept, which acknowledges both that multiple-fatality disasters are particularly repugnant to society at large and that other factors beyond the injuries caused may enter into the equation. In the nuclear case these may for example include contamination of land. It is a process, which is essentially economic and political though informed technically.

The methodology of QRA is to calculate risk in terms of fatalities, the quantified expression of this is conventionally shown in tables or in an FN curve. This curve will display the frequency F (experienced or predicted) of an event killing N or more people. The situations implied by the numbers expressed as N will vary with circumstances. For nuclear events, it would be irrelevant only to show numbers of immediate deaths. For example, the immediate deaths resulting from Three Mile Island and Windscale was 0, and for Chernobyl 33, including 2 killed by blast, yet the total after a period of time from radiation exposure will be many hundreds. A nuclear FN curve therefore should also display estimates of delayed deaths, subject to the uncertainties. For non-nuclear plant, it would be relevant to show either:

- Immediate deaths; or
- Casualties, as appropriately defined.

Questions of relative ranking of risk will arise, as well as those of differential acceptability or tolerability. QRA can only be effectively used when an "acceptable" or "tolerable" level of risk to the exposed population can be determined.

Tolerability

The definition of 'tolerable' leads to a complex debate because what is tolerable to one sociable group or individual may not be to another. The judgement of what is a tolerable risk from a given work activity should be taken as the baseline as well as considering, up to date, good practice and standards. Tolerability of Risk (TOR) is a physical framework that determines which risks are considered as unacceptable, tolerable and broadly acceptable. It is especially valuable where there are no standards or good practice to reference.

The Health and Safety Executive's framework is illustrated in figure two-four and involves acceptance of an upper limit above which a particular risk is regarded as unacceptable. This upper limit is taken to be a chance of death of 1 in 1,000 per annum for workers and 1 in 10,000 per annum for members of the public (HSE. 1988).

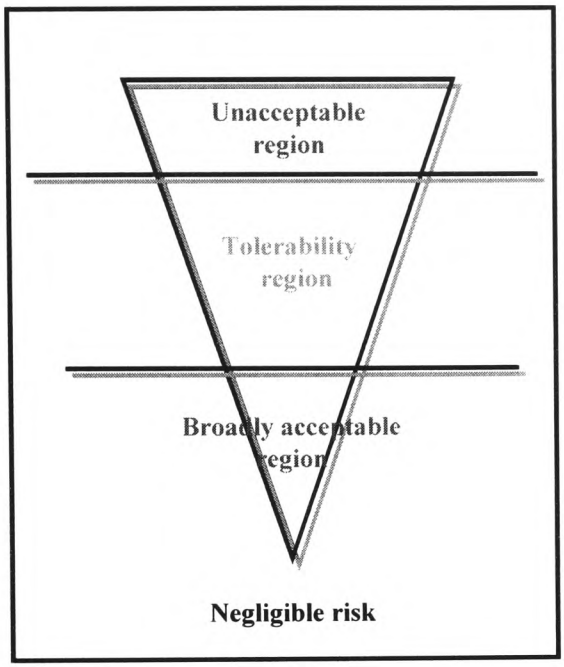


Figure 2- 4 HSE Levels of Risk and ALARP

Below the upper limit is a region where a balance has to be struck between the costs and demonstrated benefits of any increment to the existing level of safety, i.e. of risk reduction. There must, of course, be confidence that a risk is actually being controlled at the relevant level, known as ALARP (as low as reasonably practicable). The lowest point at which it would be considered sensible to address any risk would be where the chance of death from a work activity to an employee was about one in a million per year.

Cost benefits analyses (C.B.A's) are of use. However, this approach involves putting a monetary value on specified levels of harm where individual risk is involved. Within the UK for example, the Department of Transport generally places a value of life for appraisal of new road schemes currently at about £3/4 million. i.e. if a fatal accident has occurred and a road improvement will reduce the risk and the cost of the proposed improvement is £3/4 million or less then the improvement would be approved. (DETR. 1998). However, for the acceptability of societal risks, a higher figure is often used. For example in most large catastrophes a great deal more than human life is destroyed, e.g.

property and political costs are also incurred, including the very high financial costs of restoring public confidence.

Aversion Factor

It would appear that the public is very averse to certain kinds of risks. Particularly those kinds where there is no escape and no warning, with no free play for the operation of individual judgement, such as in the UK Paddington rail crash in October 1999 when thirty people were killed and a further two hundred and twenty injured. When answering a parliamentary question, the Deputy Prime Minister John Prescott, considered that the cost of installing Automatic Train Protection (ATP) devices, estimated at £850 million, should not be an issue or relevant in light of both profits made by Railtrack and the level of protection afforded to rail passengers (Daily Telegraph. 1999). This would place the cost of a life at approximately £28 million.

The detailed evaluation of societal risks is a complex question. However, the Health and Safety Executive (1998) detail one method of analysis which applies an aversion factor to the value of life for individual risk. For societal risks, it is usually three times the amount of the value for life attributed to individual risks.

The treatment of uncertainty is also of great importance in all risk and cost calculation. It leads to the view that the ALARP calculation should be biased in favour of greater safety where risks are considerable. One can adopt a 'scientific' approach in which the value of life and the tolerability of risk factor are used to calculate a value for the control measures required. However, within the UK, case law indicates that this approach will not normally succeed as it is believed that the factor described as "gross disproportion" relating to duties qualified by such as "reasonably practical" should apply - i.e. more should be paid to avert the risk than would be indicated by the standard value of life. This is because any calculation does not account for the uncertainty or unknown factors that may be present.

Therefore although cost benefit analysis has relevance in any risk assessment process, the methodology is limited by the factors above, such as the public adversity to certain kinds of risks.

Risk Ranking

Irrespective of method used or topic assessed the outcome from the risk assessment process will be:

1. Whether it is so great or the outcome so unacceptable that it must be refused altogether;

2. Whether the risk is, or can be made so small that no further precautions are necessary;

3. If the risk falls between these states, then it has been reduced to a level which is 'tolerable'.

Having carried out a risk assessment, which subsequently identifies a series of outcomes that fall within the third category above, it will then be important to determine the priorities.

The HSE's research into the role of risk ranking (HSE. 1997c) identifies the setting of priorities as playing a crucial role in the decision-making process. The research recognises that organisations have only finite resources, and with the almost infinite number of conflicting demands upon those resources, the establishment of priorities is a necessity.

'Risk ranking' is often cited as an approach, which can be used to assist in the priority-setting process. The HSE research identified that the concept of risk ranking is poorly defined and the precise meaning of the term is often left vague and ambiguous. Risk ranking covers a diverse range of approaches, which have in common the use of some kind of framework or scale for ranking or rating different factors.

The HSE's research conclusions were that multi-criteria techniques may have advantages over other methods such as cost benefit analysis.

Multi-criteria ranking systems rely upon implicit expert judgement, where the factors considered, and the relative importance attributed to different factors. Each of the factors of quantification, tolerability of risk and prioritisation of outcomes has to be accounted for in any risk assessment methodology. The literature review identifies that the majority of established risk assessment models (Bruggermann and Halfon 1990, Everley 1994 and Tweedale et al 1992) used a multi-criteria ranking system which is further refined by the application of weighting or scoring to each separate criteria.

2.7.5 Integrated Risk Assessment

The need for a mechanism to conduct risk assessment, together with mechanisms for both a significance review and audit were identified as the primary means to 'drive forward' an integrated system. Without workable integrated mechanisms, it is unlikely that the benefits of integration will be achieved.

The Gates Rubber Company (Baird. 2000) who introduced an integrated approach using BS 8800 and ISO 14000 identified the practical difficulties of implementing an integrated risk assessment. They identified that the two areas of environmental and OHS risk, although on the face of it very similar, were difficult to pull together and as a result remain separate because of the difficulty of balancing the risks, such as short term health and safety risk (such as solvent inhalation), against long term environmental risks, such as VOC's leading to global warming.

This chapter has identified the research examining the various methods for determining environmental and health and safety risk assessment. However, limited research has been undertaken to develop a detailed integrated method that will be able to undertake both environmental and health and safety risk assessment and then balance the priorities identified from each separate assessment for the integrated management standard to succeed.

2.8 Audit

2.8.1 Introduction

The origins of audits first can be traced to financial audits, which can be followed as far back as 1299 when an office of auditor was recorded for the corporation of the City of London. The methodology of such financial audits has been well developed since that time and formalised within the UK through legislation.

Whatever discipline is being audited the underlying purpose remains the same, namely: An examination, by an independent function, using a systematic and documented verification approach, of objectively obtaining and evaluating audit evidence to determine whether an organisation's management system conforms to the management system audit criteria, and communicating the results of this process to the client. The essence of any management system is to:

- Say what you do,
- Do what you say, and
- Be able to prove it.

The purpose of the audit is to be able to independently verify or otherwise this last question.

2.8.2 Reasons for Audit

The evaluation of the system effectiveness is considered to be a powerful management tool for quality improvement. In fact, many authors argue that one of the primary purposes of audits is continuous improvement (Burr, 1997, Hunt, 1997 Willborn and Cheng, 1994; Russell, 1997; Russell and Regel. 1996; Walker, 1998).

Ramsey observed that without an effective audit, all control systems tend to deteriorate over time or become obsolete as a result of change. Ramsey further observed that in reality some drift often occurs, and perhaps standards are not maintained or some unnoticed changes occur. An effective method of preventing this identified 'drift' in control of standards is by regular audit. An effective audit will identify such drift at an early stage and allow corrective action in good time. An additional benefit is one of continuous improvement. (Ramsey. 1998).

Auditing complements the planning and control cycle and is similar in concept to financial auditing or third-party quality auditing. It aims to provide an independent assessment of the validity and reliability of the management planning and control systems. For audits to be effective they should be both independent and reproducible.

2.8.3 Independence

It is important to demonstrate the independence of an audit. To achieve this the management system such as ISO 14000 is part of an accreditation scheme. Audit bodies subject to these accreditation schemes must submit themselves for accreditation to an appropriate national or international accreditation body. These main accreditation bodies include:

- United Kingdom Accreditation Service
- The European Co-operation for Accreditation
- International Agreements on Accreditation

2.8.4 Reliability of Audit

Karaptrovic and Wilborn (1999) identified that in performing auditing activities, the auditors must objectively and independently collect and verify audit evidence. Objectivity and independence were identified as two separate, yet interrelated, fundamental principles of auditing. They identify that objectivity relates to the consistency of the auditing process and results, materiality of evidence, the use of appropriate methodology, the application of a systematic approach to auditing, as well as being free from bias. Consistency, for instance, means that two auditors auditing the same system against identical criteria should come up with similar conclusions.

Another well-known reliability engineering concept can be applied to auditing, namely the bathtub curve. The bathtub concept relates to the number of failures the system experiences over time: this is shown diagrammatically in figure two-five. The situation is similar in auditing. At the inception of a new audit program, auditors are commonly inexperienced, program and individual audit objectives may be incompatible, new and relatively undeveloped systems are examined, the level of co-operation of auditees is low, and so on. Therefore, a high number of errors and misjudgments may be expected. With the passage of time, as the audit system becomes increasingly mature, and as sound audit methodologies are introduced, the rate of errors decreases. After a while, the audit system reaches its "steady-state", characterised by experienced auditors and

efficiently used methods and processes. At one point, however, audit failures may start to increase. This may be caused, for example, by the audit management's insistence on adherence to invalid or obsolete audit criteria e.g. changed rejection criteria (Wiliborn and Cheng, 1994). The audited management system appears to be compliant, when in fact it is not effective. Therefore, the audit may not adequately identify problems or areas of possible improvement, which causes the audit failure rate to increase. This is illustrated in figure two-five.

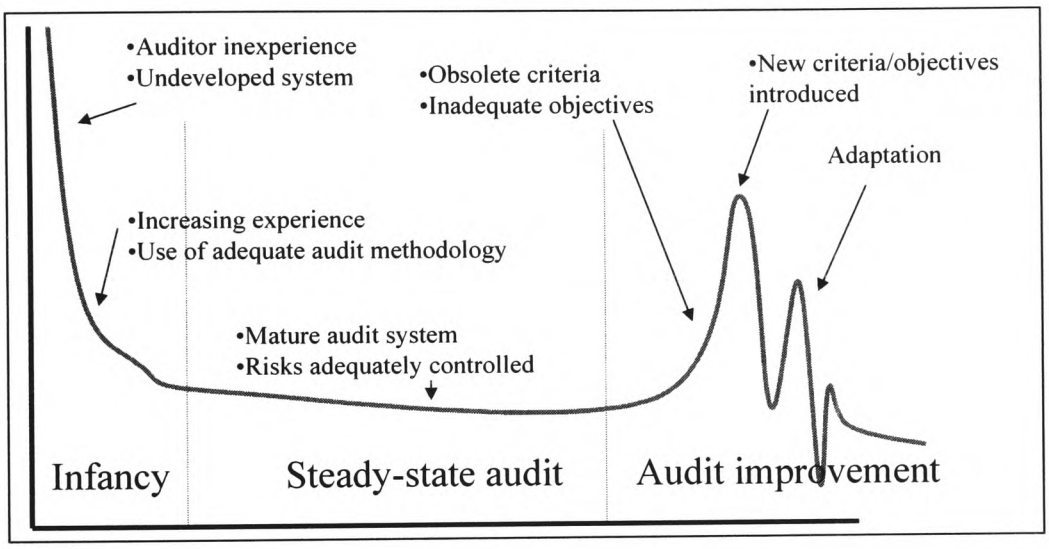


Figure 2- 5 The Bathtub Curve Identified by Karaptrovic and Wilborn for Auditing

2.8.5 Environmental Audits

Environmental audits had their origins in the USA during the 1970's stimulated principally by the Securities and Exchange Commission (SEC) actions against three companies: US Steel (1977), Allied Chemical (1979) and Occidental Petroleum (1980). The SEC required each of these public companies to undertake corporate-wide audits to determine accurately the extent of the environmental liabilities they truly faced. In essence, the SEC believed that each company was vastly understating its liabilities in its annual report to stockholders. As a result, many companies developed audit programmes. Due to the nature of the industry, the major chemical companies were at the forefront of audit programme development during this period.

The development of environmental auditing and subsequent management systems in the USA was driven by compliance to environmental legislation and institutional requirements. The history of environmental auditing in Europe has, to some extent, been driven by American parent companies, however the regulatory regimes and associated environmental liabilities are not as severe in Europe and the need to audit is more market driven.

Environmental auditing was initially developed as a management tool to address compliance with legal and regulatory requirements, but has now come to encompass a wide, and sometimes confusing, range of activities such as sustainability audits etc.

One of the primary factors suggested that influence a corporate response on environmental audits is the growth in awareness and concern in the general community, as argued by Hines:

> "There appears to be a strong demand for companies to be made accountable for the environmental impact of their actions. . . that firms have an implicit contract with, and should therefore be accessible to, the wider community in which they operate" (Hines, 1991).

This 'new' environment was summed up by Elkington (1994):

> "The challenge facing individual companies will be to work out new ways of co-operating with their suppliers, customers, and other stakeholders, including competitors, in this key area of business activity, while ensuring that they will benefit not only in corporate citizenship terms, but also in terms of competitive advantage".

Definition of Environmental Audit

A commonly used definition of environmental audit has been that of the International Chamber of Commerce (ICC), a variant of which is used in the EC Eco-Management and Audit Regulation (EMA):

> "A management tool comprising a systematic, documented, periodic and objective evaluation, of how well environmental organisation, management and equipment are performing with the aim of safeguarding the environment by:
>
> 1) facilitating management control of environmental practices; and
> 2) assessing compliance with company policies, which would include meeting regulatory requirement."

However, a somewhat different definition has recently been proposed by the International Standards Organisation Strategic Advisory Group (ISO/SAGE):

> "A systematic process of objectively obtaining and evaluating evidence to determine the reliability of an assertion with regard to environmental aspects of activities, events and conditions, as to how they measure to established criteria, and communicating the results to the client."

This more closely reflects the traditional concept of auditing in general, as involving the systematic gathering of evidence to test a verifiable assertion. On this basis, many activities historically passing under the generic name of "Environmental Audit" would probably be better identified as "Environmental Reviews."

ISO 14000 Environmental Management Scheme Audit

An environmental audit is defined in ISO 14010 as:

> "A systematic, documented verification process of objectively obtaining and evaluating audit evidence to determine whether specified environmental activities, events, conditions, management systems, or information about these matters conform with audit criteria, and communicating the results of this process to the client."

In itself this definition is of limited use, as it defines the audit in terms of the audit criteria. This criteria is defined in ISO 14011 as the:

> 'Policies, practices, procedures or requirements such as those covered by ISO 14001 and if applicable any additional EMS requirements against which the auditor compares collected audit evidence about the organisation's environmental management system'.

Eco-Management and Audit Scheme Audit

The accredited audit is a key part of the Eco-Management and Audit Scheme (EMAS) and is defined as:

> "An environmental audit shall mean a management tool comprising a systematic, documented, periodic and objective evaluation of the performance of the organization, management system and processes designed to protect the environment with the aim of:
>
> (i) facilitating management control of practices which may have impact on the environment;
>
> (ii) assessing compliance with company environmental policies."

The annexes of these regulations provide supplementary details on the requirements concerning the accreditation of environmental verifiers and their function (Annex 111).

The audit is required to be planned and executed in the light of the relevant guidelines in the ISO 10011 international standard (1990, Part 1).

2.8.6 Health and Safety Audits

Since the 1960s a number of commercial audit systems within the UK have been available. However, these were not true audit systems, because they would not be measuring against a management system, but simply inspections of physical standards regarding health and safety.

Definition of a Health and Safety Audit

In 1991 the UK Health and Safety Executive publication HS(G) 65 contained a definition of a health and safety audit as:

> "In addition to routine monitoring of occupational health and safety performance, there will be a need for periodic audits that enable a deeper and more critical appraisal of all the elements of the OH&S management system."

Audits should be conducted by persons who are competent and independent from the activity that is being audited, but may be drawn from within the organisation. At different times and for different reasons, audits will need to cover the following questions:

a) Is the organisation's overall OH&S management system capable of achieving the required standards of OH&S performance?
b) Is the organisation fulfilling all its obligations with regard to OH&S?
c) What are the strengths and weaknesses of the OH&S management system?
d) Is the organisation (or part of it) actually doing and achieving what it claims to do?

This definition is very similar to subsequent definitions contained within the British Standards BS 8800. In April 1999 British Standards published OHSAS 18001, Occupational Health and Safety Management Systems – Specification. This standard did not replace BS 8800. It was published, not by the standards making body of BSI, but by the quality assurance commercial body of BSI the Product Approval specification (PAS).

The key difference between BS 8800 and OHSAS 18001 was that OHSAS 18001 is a certifiable standard, but it is not an accredited standard, unlike BS 8800 which is neither certifiable or accredited. (BSI 1999)

OHSAS 18001 management standard requires an audit component, namely:

'The organisation shall establish and maintain an audit programme and procedures for periodic occupational health and safety management system audits to be carried out in order to;

a) Determine whether or not an occupational health and safety management system:

1. conform to planned arrangements for occupational health and safety management including requirements of this occupational health and safety management system specification;
2. has been properly implemented and maintained; and
3. is effective in meeting the organisation's policy and objectives;

b) Reviewed results of previous audits;

c) Provide information results audit to management.

"The audit programme, including a schedule, shall be based on the results of risk assessment of the organisation's activities and results of previous audits. The audit procedures shall cover scope, frequency, methodology and competence as well as the responsibilities and requirements for conducting the audits and reporting results. Wherever possible, audit shall be conducted by personnel independent of those having direct responsibility for activity being examined"

The key difference in the development of health and safety audits in support of a health and safety management scheme is that whilst they may be certificated such as OHSAS 18001, they are not accredited schemes unlike environmental or quality management scheme audits. Therefore the issue of auditors reproducibility, without accreditation, remains an issue.

2.8.7 Comparison of Environmental and Health and Safety Audit

Environmental and health and safety audits share common features in that both audits require assessment of compliance against standards which are often legal, as opposed to quality which is against internal or customer requirements.

Whatever audit protocol used, the underlying purpose of an audit is to examine standards by an independent function using a systematic and documented verification approach. This objectively obtains and evaluates audit evidence to determine that the organisation's management system conforms to the management system audit criteria and the results are communicated to the client. This remains an effective way of achieving both compliance to standard and continuous improvement.

2.8.8 Integration of Occupational Health, Safety and Environmental Auditing

There are certificated schemes for auditing health and safety and environment. There are links within these certificate schemes, however there is no existing accredited uniform health safety and environmental audit protocol. The need for a mechanism to conduct an integrated audit has been identified as one of the primary means to 'drive forward' an integrated system. Without workable integrated mechanisms, it is unlikely that the benefits of integration will be achieved.

The practical difficulties of implementing an integrated audit have been identified previously. For example Gates Rubber Company within the UK introduced an integrated approach using BS 8800 and ISO 14000 and identified that:

> "one of the core problems experienced by the non-safety or environmental professional during an integral audit was the blurring of the environmental and OHS boundaries- when did environmental issues finish and safety start? When does an environmental issue become a safety issue?" (Baird. 2000).

Whilst there are methods for determining audits for both environmental and health and safety risks, it will be necessary to develop an integrated method, which will be able to undertake both environmental and health and safety audits and then balance the non-conformances identified from each element of the audit. Not only such an integrated method will have to be developed but also there will need to be developed a means of prioritising the outcomes of the audit process.

2.9 Chapter Summary

By examination of the current literature, chapter two has addressed research questions one and three, contained in chapter one, table one-two:

Question one:	*'Establish the current status use and application of individual management systems and standards'*
Question three:	*'Explore the concept of integrated management standards within organisations'*

The outcomes are summarised as:

For question one: *'Establish the current status use and application of individual management systems and standards:'*

Quality

The ISO 9000 series is by far the dominant standard for which it is perceived that registration does improve quality. A new revision of the International standard is imminent.

Environment

Like quality management standards, there has been a similar growth in the number of registrations with environmental management systems although ISO 14000 outstrips EMAS in numbers for registrations by a factor of four.

The reasons stated by organisations for registering with such schemes are often based upon conformance with consents and better relationships with the regulators because of possible reduced levels of regulatory oversight of companies with formalised environmental management standards.

Health and Safety

Unlike quality or the environment, there are no European or International Occupational Health and Safety Management Systems. There is less popularity for organisations to introduce individual national stand alone health and safety standards at present.

Integration

This review has identified that there has been pressure from many bodies to introduce an integrating management system. However, the key research has suggested that the benefits are not clear and that little beyond a policy level integration has been successfully introduced to date. Whilst it is technically feasible to integrate quality with environment and health and safety, the similarities between environment and health and safety are greater than quality. Therefore, in the first instance, it is logical to link these two together, with the aim of integrating quality at a possible later date.

For question three: *'Explore the concept of integrated management standards within organisations.'*

This literature review suggests that in any organisation, there are five separate levels of implementation of the management system, as shown in figure two-three. A fully integrated quality, health safety and environmental management system would have to be effective and beneficial at all five levels before this research can conclude that integration has been successfully achieved. There is also a link between culture and performance. Specifically the organisational culture will influence the quality, environmental or health and safety performance. Therefore the culture of the organisation will influence the feasibility of integration as some organisational cultures will integrate better than others.

Chapters three and four will detail the research methodology and results obtained from the development of a proposed integrated health, safety and environmental management standard and the detailed supporting tools contained in the appendices.
This research will address the research questions two, four and five:

Question two:	*'Evaluate the relationship between the existence of formalised health safety and environmental management systems within an organisation and the levels of physical control (risk) and explore the possible benefits'*
Question four:	*'Develop an integrated standard with supporting tools and explore the feasibility of implementation'*
Question five:	*'Review the applicability of an integrated management standard within the context of national and European legislation'*

Chapter 3.0 Methodology

3.1 Introduction

Chapter two examined the current literature and established the current position regarding management systems. Chapter three will detail the research methodology selected for the development of a proposed integrated health, safety and environmental management standard and the detailed supporting tools contained in its appendices. This chapter will detail the methodology employed to address research questions two, four and five, contained in chapter one, table one-two:

Question two:	*'Evaluate the relationship between the existence of formalised health safety and environmental management systems within an organisation and the levels of physical control (risk) and explore the possible benefits'*
Question four:	*'Develop an integrated standard with supporting tools and explore the feasibility of implementation'*
Question five:	*'Review the applicability of an integrated management standard within the context of national and European legislation'*

The overall aim of this research was to develop an integrated standard and determine whether the integration of environmental and occupational health and safety management systems is a practical proposition. A key feature of the proposed draft management standard was that company personnel without prior specialist health, safety or environmental training would be able to implement it. Management standards are most effective if they are owned by the personnel within the organisation rather than imposed. It was necessary to develop specific tools to ensure that company personnel would be able to plan, implement and monitor this standard themselves.

3.2 Research Design

An overview of the stages of this research is detailed in table three-one. The research approach was separated into two discrete approaches:

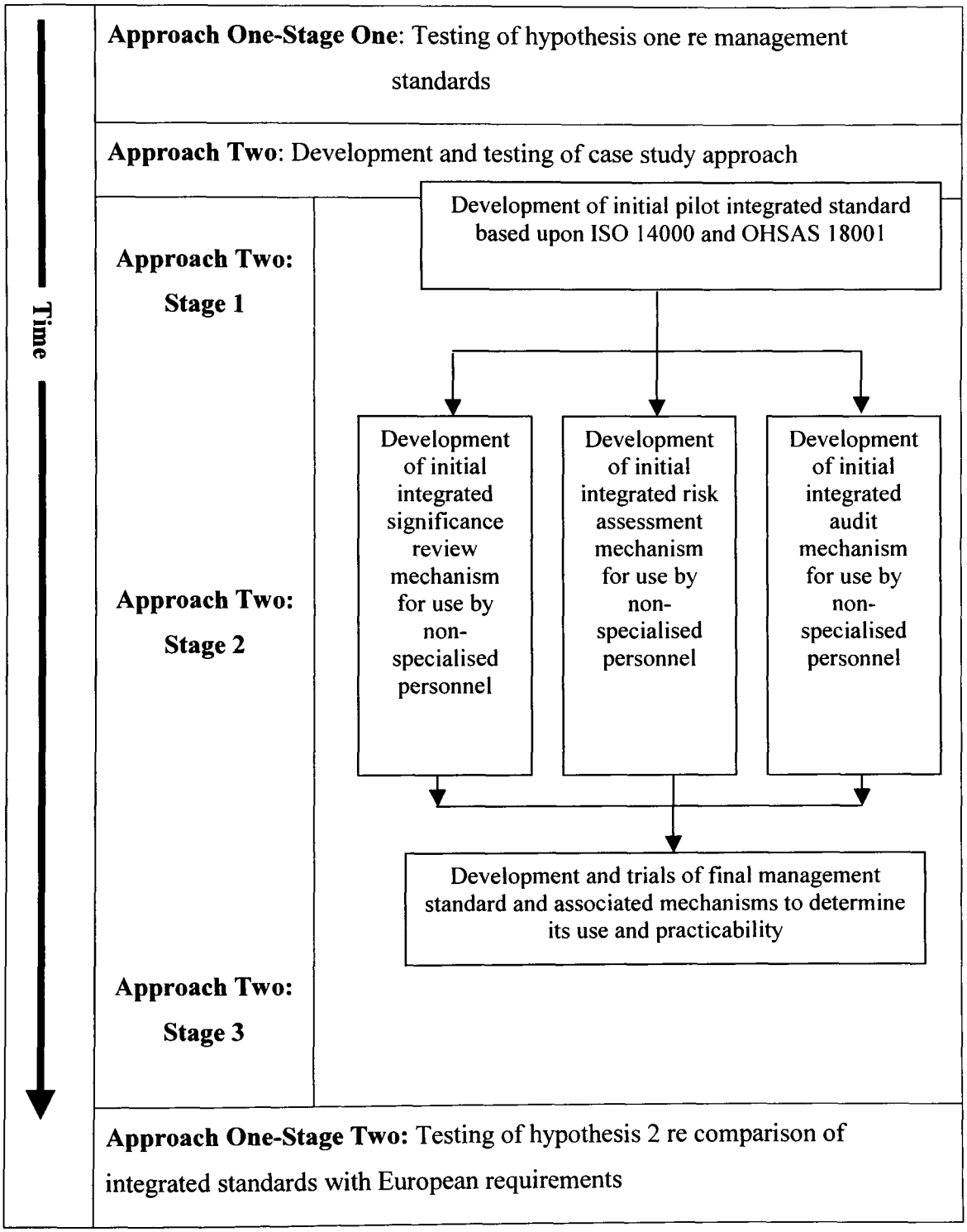
Approach one

Research question two: management systems and question five: meeting national and European legal requirements, could be tested by the proposal of two separate hypothesis for each research question, which could then be measured against agreed criteria and then statistical analysed to determine if the proposed hypothesis were demonstrably valid. This is discussed further in section 3.2.1.

Approach two

For research question two; the development of the proposed integrated health, safety and environmental management standard and the detailed supporting tools, a case study approach was adopted because several factors contributed to the inappropriateness of forming a hypothesis for these elements of the research. The rational for this approach is detailed in section 3.2.2.

Table 3- 1 Stages of research



3.2.1 Approach One: Management Systems and Legal Requirements Hypotheses

Research question two: the relationship between management standards and performance standards can be summarised by the general hypothesis that an organisation will achieve high standards of physical control of health, safety and environment if there is a formalised, preferably externally accredited, management standard.

To test this relationship in this study the following null hypothesis is proposed:

H0 $_{(1)}$ that organisations with formalised health, safety and environmental management standards are likely to achieve higher standards of physical control.

The second hypothesis to be tested regarding research question five is that of the relationship between a proposed health, safety and environmental management standard and all relevant national and European legal requirements. To test this relationship the following null hypothesis is proposed:

H0$_{(2)}$ that the proposed health, safety and environmental management standard meets all relevant health, safety and environmental national and European legal requirements.

Both H0 $_{(1)}$ and H0 $_{(2)}$ were tested using a t test, as discussed in section 3.2.6.1.

3.2.2 Approach Two: Proposed Integrated Health, Safety and Environmental Management Standard

A case study approach was adopted because several factors contributed to the inappropriateness of forming a hypothesis for these elements of the research. Firstly, the introduction of health and safety management standards is relatively recent into the UK. There are competing environmental standards (ISO and EMAS) and for health and safety there is no internationally/European agreed standard. Secondly, the development of management systems and performance indicators is embryonic (Wells et al. 1994) particularly for health and safety. This makes the assessment and comparisons of organisational practice less clear. Thirdly, the development of a single hypothesis would be inappropriate for such a diverse standard incorporating the integrated significance review, risk assessment and audit, for which some or all of these developed methodologies may or may not be useable. Finally, the development of integrated significance review, risk assessment and audit methodologies was novel.

For all these reasons the research was exploratory and was undertaken to determine if a proposed health, safety and environmental management standard and detailed supporting appendices would be practicable for organisations to introduce and manage internally.

The research initially developed and tested the proposed health, safety and environmental management standard and separately the tools of integrated significance review, risk assessment and audit by means of separate case studies. Once this developmental phase was completed, the final full-proposed health, safety and environmental management standard were selectively tested by means of case studies. The stages of this research are shown in table three-one.

3.2.4 Research Participants

The following factors were considered in the selection of a range of suitable organisations:

1) The organisations had a recognised impact in terms of health, safety and the environment. In practical terms, by selecting the majority of sites who were subject to the UK Control of Major Accident Hazards Regulations (COMAH), this by definition demonstrated a suitable range of significant impacts required.

2) The organisations were additionally required to have a sufficient range of health, safety and environmental hazards to prioritise significant risks and focus on those with the greatest potential for loss, i.e. to separate the trivial from the significant risks.

3) As the integrated draft management standard should be effective irrespective of the size of organisation, the testing of the standard included a range of employment sizes from small and medium enterprises to multi-national organisations.

4) Be trading in a European/International market where one national system would be inappropriate.

Based upon these criteria, the research focussed primarily upon manufacturing sites. Any significant health, safety and environmental loss would have the greatest potential for harm in these organisations and, therefore, it was important to ensure that the draft standard and associated tools worked effectively in these circumstances. An early test of a non-manufacturing organisation was selected (a multi-national food retailer, Sainsbury's) see section 4.5.2 and this test further confirmed the relevance of the above criteria.

3.2.5 Validity of the Significance Review/Audit Score

To minimise the auditor's subjectivity and bias, the audits were conducted in comparative teams. Team one comprising of appropriately qualified auditors who were, at least, corporate members of the appropriate professional body and had at least three years practical auditing experience. This was to ensure an adequate knowledge of acceptable/agreed minimum legal standards. Team two comprised of non-professionally qualified personnel, usually from the trial organisation, utilising the developed system for significance review and audit proforma. The trials were concerned with the correlation of the results obtained from team one against team two.

To further minimise investigator bias and evaluator error, the audits were conducted by each of the two teams independently, but within tight timescales, to minimise any changes in baseline conditions. Additionally, each member of team one (independent, professionally qualified) audited separately and compared audit findings/scores. Where there were differences, the reasons for these differences were discussed between each team member and an agreed outcome was obtained, thus introducing a quality test to the results.

3.2.6 Statistical Analysis

3.2.6.1 The size of sample

The statistical technique 'Student-t test' was used to establish confidence limits, thereby ensuring that the conclusions drawn were statistically significant and reproducible. Alternative statistical techniques were considered:

f statistic: A ratio measure which assesses the variance within a group and the variance between groups.

z statistic: Based on Gaussian distribution.

However, the Student t-test was selected because it was based on a t distribution, i.e. for a small sample size of 30 or less.

3.2.6.2 Correlation of comparative data

Where two sets of data had been collected and it was necessary to establish a relationship the correlation coefficient was calculated. A correlation coefficient is a number between -1 and 1 which measures the degree to which two variables are linearly related. If there is perfect linear relationship with positive slope between the two variables, there is a correlation coefficient of 1. There is positive correlation where the variable has a high, high (or low, low) value. If there is a perfect linear relationship with negative slope between the two variables, we have a correlation coefficient of -1. There is negative correlation where one variable has a high, low (or low, high) value. A correlation coefficient of 0 means that there is no linear relationship between the variables.

There are a number of correlation coefficient methods of calculation:

- Pearsons Product Movement
- Least square
- Regression equation
- Spearman rank correlation coefficient

The Spearman rank correlation coefficient was selected because it is used when it is not convenient, economic, or even possible to give actual values to variables, but only to

assign a rank order to instances of each variable. This rank correlation coefficient technique is used for the comparison of management standards and physical control.

3.2.6.3 Sensitivity Analysis

A simple sensitivity analysis consists of determining by how much the estimates used in the solution would have to be in error before the propose solution performs less satisfactory than the alternative decision procedure. In this case, a simple sensitivity analysis technique was developed where a unit changed in any one of the three variables was considered and analysed for its sensitivity to the overall outcome. This sensitivity analysis technique is used for the weighting scale of the significance review methodology.

3.2.7 Research Ethics

The majority of the organisations used for the trials were known previously to the author because the organisations had to be prepared to commit resources to supporting the various trials. All findings, including negative ones, were notified to the organisations in the form of a written report. Those personnel undertaking trials on the author's behalf followed a research protocol. i.e. independent auditors. The protocol mirrored the two relevant UK professional bodys' code of conduct: the Institute of Occupational Safety and Health (IOSH) and the Institute of Environmental Management and Audit (IEMA) as the relevant personnel belong to one or other of these bodies. These codes of conduct included obligations to report significant findings etc.

The organisations used to test whether effective implementation of management systems improve physical control standards hypothesis, were taken from core data from twenty-four companies over a two-year period (February 1998 to February 2000) from a range of manufacturing, service and public sector activities (details are contained in table three-two).

These were organisations that had contracted with my employer to undertake health, safety and/or environmental audits. All data was used, within that time-frame, to minimise selection bias and audits were undertaken by different personnel all meeting the criteria in 3.2.5 and following an agreed research protocol, again to minimise auditor bias.

3.3 Identification of the Advantages and/or Disadvantages of Management Systems

3.3.1 Methodology

A series of health, safety and/or environmental audits were undertaken in a range of companies. Each audit examined two components: the physical standards for the control of risk; and the organisational arrangements for the management system. Each component was then scored using the SHEMA Ltd (SHEMA. 1997) scale contained in table three-two and plotted against each other on a graph, to determine:

1. Whether the organisation had an existing documented management system;

2. Whether an average or above management system resulted in average or above physical standards for the control of risk.

Details of scoring system selected.

The scoring system described in table three-two was previously developed using a two-criteria ranking and five point scoring system.

The two selected ranking criteria were:

1. Degree of formalised management system; and
2. Degree of physical control measures for the identified risk.

The five point scoring criteria

Each of the two ranking criteria was then divided into a five point score based upon defined criteria. This criterion was developed from the Dow index, which was a fire and explosion index with five degrees of compliance. (Andreasen and Rasmussen. 1990). This five point scoring system is a common element throughout a number of risk ranking models (US EPA. 1987) and is proposed as a/the measure of non-compliance within the proposed revision to ISO 9000 Quality management systems.

Accuracy of results

The aim was to ensure that the correlation determined above was a 'true' correlation of two dependent variables and not a mask of another variable, such as the individual management personalities and strong leadership rather than formalised standards correlating to above physical standards for the control of risk.

The possible variables to achieve full correlation were:

1. The documented presence of a formalised externally accredited management standard in place e.g. ISO 14000, EMAS, against;

2. Independent measurement of the physical control of risk to the agreed standards of compliance with most, if not all, of the applicable requirements reviewed. For the requirements, where exceptions are noted, the departures should be occasional, anomalous and inconsequential in comparison to the overall level of compliance achieved.

The scale selected in table three-two was such that other variables such as those previously mentioned, would be identified separately within the scale. So that there would be no possibility of a full correlation between for example strong leadership and above physical standards for the control of risk as the audit criteria would score C/A not A/A in the case of formalised standards. Therefore if the results of the audits demonstrate a suitable spread then the variables being compared of management standards verses physical control are the prime variables and not masking any other prime variable.

To further ensure the reliability of this data a simple sensitivity analysis was undertaken.

Table 3- 2 Comparative Audit Scales

Score	The standard of management system implemented	Score	The standard of health, safety and/or environmental risk control
A	Full formalised externally accredited management standard in place e.g. ISO 14000, EMAS	A	Meets governmental and/or the company requirements. The unit complies with most, if not all, of the applicable requirements reviewed. For those requirements where exceptions are noted, these departures are occasional, anomalous and inconsequential in comparison to the overall level of compliance achieved.
B	Full formalised non-accredited, but certificated, management standard in place e.g. BS 8800/OHSAS 18000.	B	Substantially meets governmental and/or the company requirements. The site complies with most of the applicable requirements reviewed, and only a few requirements were not satisfied. These departures, however, represent isolated and anomalous exceptions in an otherwise effective compliance programme.
C	Full documented non-accredited internal company management system/standard with no external verification. Minimum documentation required: - A policy; - A strategic plan; - Some form of routine monitoring of this plan; - A formal method for the control of risk e.g. documented risk assessment; - Formalised training matrix; - An audit or review mechanism.	C	Generally meets governmental and/or the company requirements except as noted. The site complies with many, but not most of the applicable requirements reviewed. The exceptions noted are not analogous, but reflect patterns or weaknesses in the design and/or implementation of compliance programmed
D	Informal management system in place with some form of written policy, plan and some form of routine monitoring.	D	Requires improvement to meet governmental and/or the company requirements. The site complies with some of the applicable requirements reviewed, but many were not satisfied. The exceptions noted reflects the absence of required programmed significant departures from established criteria, or lapses in programme implementation.
E	No evidence of any management system.	E	Requires substantial improvement to meet governmental and/or the company requirements. The site complies with a few of the applicable requirements reviewed and most were not satisfied. The exceptions noted include several significant departures from established criteria, the absence of several required programmes or prolonged inattention to the resolution of previous identified compliance or liability issues.

3.4 Determination of the Need for Integrated Management Systems

3.4.1 Purpose of the integrated management systems

Approach two:-stage one of the research, as illustrated in table three-one was to determine if there was a perceived need by organisations for the integration of the existing management standards into one standard and, secondly if so, which standards should be integrated?

3.4.2 Methodology

As part of previous research (Newbury. 1997) a questionnaire was developed which was then sent to organisations with existing management standards. This questionnaire addressed the following major issues:

1. Did organisations either have or want a combined health and safety and environmental management system?

2. Did organisations either have or want a combined health and safety, environmental and quality management system?

3. Did organisations perceive any advantages in a combined management system?

4. Did organisations perceive any disadvantages in a combined management system?

The responses to these questionnaires were analysed to determine if there was a perceived need by organisations for an integrated health, safety and environmental management standard.

3.5 Development of Pilot Integrated Standard

3.5.1 Purpose of the integrated management systems

Previous research had developed a framework system based upon ISO 14000 and BS 8800.

3.5.2 Methodology

A limitation of the original framework was that it only described the top-level policy, without detailing how the policy statements could be implemented. Therefore further development was necessary at approach two:-stage two of the research, as illustrated in table three-one, to develop the detailed appendices containing the mechanisms of integration beyond the policy level:

1. Organisational arrangements;
2. Emergency planning;
3. An initial significance review;
4. Integrated risk assessment;
5. An audit protocol.

3.6 Development of an Integrated Significance Review

3.6.1 Purpose of the Significance Review

In any management system the purpose of the significance review is to determine the current levels of organisational performance against agreed minimum standards, usually legal. This can then be used to establish priorities for risk assessment and risk control.

3.6.2 Methodology

A methodology was developed which would quantify both of the potential risk and existing control measures to allow a numerical score for each separate health, safety and environmental topic. This would then be ranked against one another.

This was tested and the results were evaluated and used to modify the significance review. The purpose of the test was:

1. To determine if the methodology would identify the relative significance of each topic by comparison with independent professional assessment;
2. To develop the system to be clear and acceptable to the non-professional user;
3. To develop a scoring system which would highlight adequately those risks which presented the highest potential loss for an organisation in terms of human life, environmental impact, finance, reputation and manufacturing capability;
4. To ensure compatibility with existing management standard requirements for significance reviews.

3.6.3 Validation

In order to ensure compatibility with existing management standards, sites were chosen which had previously undertaken a significance review to a specific standard such as ISO 14000.

The results obtained from each of the significance review trials were therefore analysed against:

1. An independent health and safety and/or environmental significance review undertaken by qualified health, safety and environmental professionally qualified and experienced personnel, as detailed in section 3.2.5 and;

2. Against previous significance review outcomes.

Additionally, the scoring system developed was subject to a simple sensitivity analysis. The purpose of this analysis was to determine the potential variability of the scoring system.

3.7 Development of an Integrated Risk Assessment Mechanism

3.7.1 Purpose of the Integrated Risk Assessment.

Risk assessment is used to estimate the magnitude of risk and then to determine whether or not the risk is tolerable or acceptable, through a process of risk estimation and risk evaluation.

3.7.2 Methodology

The purpose of this element of the research was to develop an integrated risk assessment method for environment and health and safety, which would determine the balance between the three major topic areas of health, safety and environment.

The concept behind the development of the risk assessment model was to develop a method by which an organisation could identify the following for all health, safety and environmental issues:

1. Hazard identification;
2. Who or what was affected;
3. The existing control measures to mitigate the risk;
4. A judgement to determine whether the risk was controlled to an acceptable level, by reference, where possible, to external standards; and
5. Further action required to mitigate the risk to an acceptable level.

The integrated risk assessment methodology was tested at a range of organisations subject to the research protocol detailed in section 3.2.4, the results analysed and the methodology was modified. Subsequent versions of the risk assessment methodology were developed and tested on an iterative loop, until the final developed version met the original purpose. This was then incorporated into the proposed integrated standard.

3.8 Development of an Integrated Audit Mechanism

3.8.1 Purpose of the Audit

The purpose of an integrated health, safety and environmental audit is to examine, by independent function, a systematic and documented verification approach, objectively obtaining and evaluating audit evidence to determine whether an organisation's integrated health, safety and environmental management system conforms to the management system audit criteria.

3.8.2 Methodology

The audit methodology had to determine the balance between the three major topic areas of health, safety and environment. The concept behind the development of the audit model was to develop a quantifiable questionnaire subdivided into two parts:

- Part A examining the management system; and
- Part B examining the physical control of health safety and environmental risks.

Each part was then ranked separately and in combination. The score could then be used to measure objectively the organisation's health, safety and environmental performance over time.

Many of the audit systems examined in the literature review have a simple yes or no reply to each question. However, the reality is often not as straight forward as:

Yes there was compliance or;

No there was non-compliance.

This would fail to recognise the site where significant progress had been made, but full compliance had not yet been achieved. Therefore, a subjective rating for none, some and full compliance with the audit questionnaire was required.

An integrated audit was developed with the following features:

1. The audit should be able to identify areas of non-conformance against standards;

2. The audit should be able to prioritise areas of significant non-conformance;
3. The audit should be able to be used by non-health, safety or environmental specialists;
4. The audit should be able to be used as a benchmark of performance with time and as a comparison against different organisations;
5. The results should be transparent and easily understood;
6. The audit should not take significant resources to complete.

The integrated audit methodology was developed and the results analysed. The integrated audit methodology was modified in light of this evaluation and subsequent versions of the integrated audit methodology were developed and tested on an iterative loop, until the final developed version met the original purpose. It was then incorporated into the overall integrated management standard.

3.8.3 Validation

The audit was tested on a range of organisations with formal and informal management systems in order to ensure compatibility with the results obtained from previous management audits such as ISO 14000.

3.9 Development and Trials of the Final Proposed Management Standard

3.9.1 Purpose

The aim of approach two:-stage three of the research was to test the completed draft proposed integrated health, safety and environmental management standard to determine if there were any perceived advantages or limitations of its implementation.

3.9.2 Analysis

The final analysis of the standard was measured against the following criteria. Did the management standard:

1. Fully or partly eliminate/reduce the risk to all stakeholders who may be exposed to health, safety and environmental risks associated with its activities?
2. Maintain and continuously improve performance?
3. Demonstrate conformance to others?
4. Be easy to implement and use?
5. Be suitable for all or specific organisational activities?
6. Balance priorities of different major topics of health, safety and environment?
7. Meet both national and European legal requirements?

The elements that were tested of the developed integrated management standard were measured against these criteria. This measurement/comparison was undertaken by means of both:

The participating organisations, after implementing parts of the integrated management standard, were asked to comment by means of a questionnaire on the perceived advantages or otherwise of the integrated standard; and

A subjective comparison, undertaken by the author, of the value of implementation to the participating organisations of the relevant elements of the developed integrated management standard.

3.9.3 Limitations

The methodology stage recognised that it was not possible to introduce an entire draft integrated management system and the associated tools in any one organisation. To implement a non-integrated management standard such as ISO 14000, is estimated to take an organisation an average of between two to three years (ISO.2000c). Therefore, in the time available it was only possible to develop and test elements of the draft integrated standard in different organisations, as opposed to introducing the entire draft integrated standard into one organisation. Further, whilst the organisations themselves were willing to allow testing of some elements of the system, they were not prepared to commit significant resources and time to fully implementing an unproven system.

Whilst the research was not able to test the whole draft standard, it did give sufficient information to identify possible advantages and disadvantages.

3.10 Review of the Acceptability of the Proposed Integrated Standard with European Requirements

3.10.1 Purpose

The aim of approach one:-stage two of the research, as illustrated in table three-one, was to determine whether the proposed integrated standard contained all the elements of other non-integrated European management standards and additionally, met the European Union Member State requirements for occupational health and safety, and environmental current legal requirements, as of May 2000.

3.10.2 Methodology

European management standards and current individual member state legal requirements were established by direct contact with either the individual member states' governmental organisations or the European co-ordinating organisations. Specifically, the European Agency for Safety and Health at Work, the European Environment Agency, the European Commission Departments V and Xl and the International Labour Organisation.

After establishing the above, a comparison was made with each element of the proposed draft integrated standard and the hypothesis was tested, by the following null hypothesis which is proposed:

$H0_{(2)}$ that the proposed health, safety and environmental management standard meets all relevant health, safety and environmental national and European legal requirements.

$H0_{(2)}$ was then tested using a t test.

3.11 Conclusions

3.11.1 Methodology

After completing all the research stages described above, conclusions were drawn with regard to the feasibility and practicality of adopting the proposed integrated health, safety and environmental management standard.

The analysis from section 3.3 would determine whether management standards are beneficial and can be integrated. This would address research question two: '*Evaluate the relationship between the existence of formalised health safety and environmental management systems within an organisation and the levels of physical control (risk) and explore the possible benefits*'.

The analysis from section 3.4 to 3.9 would determine if the integrated standard was feasible and practical. This would address research question four: '*Develop an integrated standard with supporting tools and explore the feasibility of implementation*'.

The analysis from section 3.4 to 3.9 would determine if such a draft standard met both European and member states' national requirements. This would address research question five: '*Review the applicability of an integrated management standard within the context of national and European legislation*'.

Chapter 4 Research Results

4.1 Introduction

Chapter three detailed the research methodology selected for the development and trials of a proposed integrated health, safety and environmental management standard and the detailed supporting tools contained in its appendices. This chapter (four) will detail the results obtained from the various field trials of the proposed integrated management standard and the associated tools. The first and final versions of each tool are described in detail. Details of the intermediate developmental versions are described in outline only, for clarity. On completion of the trials the results were analysed and conclusions drawn for each of the relevant research questions, namely:

Question one:	*'The possible benefits of management systems;'*
Question three:	*'What is meant by integration?'*
Question four:	*'Whether integration is feasible;'*
Question five:	*'Whether integrated management systems meet national and European legal requirements.'*

4.1.1 Advantages and Disadvantages of Management Systems

To determine whether there are practical and tangible benefits of management systems, twenty-four health, safety and/or environmental audits were conducted.

The outcome of each audit was scored against two scales, assigned a ranking and then plotted on a graph using the following axes:

X axis - The standard of management system implemented;
Y axis - The physical standards for control of health, safety and/or environmental risks.

Each axis was divided into a five-scale criterion, as detailed in chapter three, table three-two. The results of each individual audit, the organisation's activity and size are detailed in table four-one.

Table 4- 1 Audits Results

	Activity	Employment Numbers	The standard of management system implemented	The standard of health, safety and/or environmental risk control
1	Engineering	200	D	D
2	Engineering	200	D	C
3	Engineering	100	D	C
4	Site Installations	20	D	C
5	Site Installations	25	C	B
6	Electronics	2,300	A	B
7	Woodworking	23	E	E
8	Engineering	147	C	C
9	GRP/Woodworking	110	B	B
10	Engineering	100	D	C
11	Rubber hose	70	D	D
12	Hospital	8,000	D	C
13	Flour milling	70	C	B
14	Flour milling	70	C	B
15	Flour milling	70	C	B
16	Flour milling	70	C	C
17	Woodworking	220	E	D
18	Pharmaceutical	230	A	A
19	Retail	450	C	C
20	Laboratories (Hospital)	320	C	B
21	Laboratories (Research)	100	A	A
22	Trade waste plant	3	A	B
23	Engineering	270	B	B
24	Printers	360	D	C

4.1.2 Analysis/Discussion

The results are shown graphically in figure four-one.

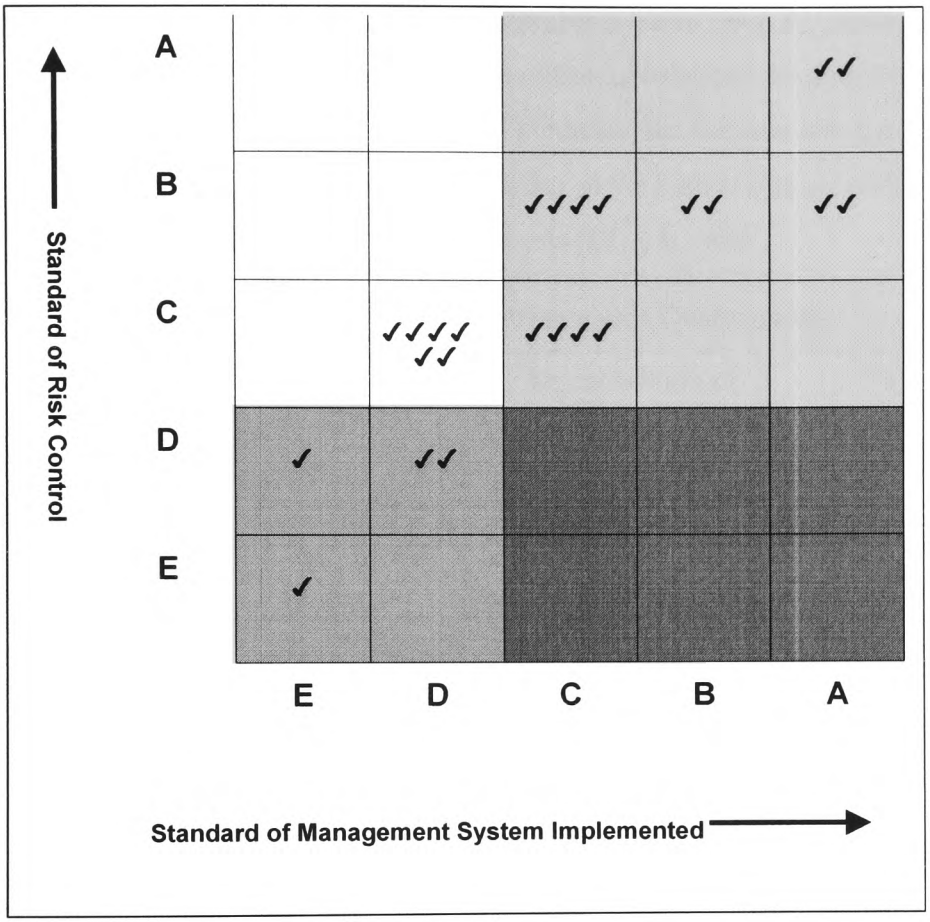


Figure 4- 1 The Relationship Between Management Systems and the Standard of Risk Control

4.1.2.1 Analysis of null hypothesis

To test the hypothesis H0 $_{(1)}$ that organisations with formalised health, safety and environmental management standards are likely to achieve higher standards of physical control, the results were calculated at the 10% level based upon a 't' data sample of n = 24 for each of the data sets. The results of the calculations are detailed in table four-two. This indicated that there is significant evidence that the data obtained is within the acceptance criteria (where both sets were either at the high scales on each axis or on the low scales of each axis) and that the hypothesis H0 $_{(1)}$ is valid.

Table 4- 2 Calculation Hypothesis of Audit/Standards Observations

Score	$\frac{X - \mu}{\sigma}$	Reject criteria of 10%	Reject Yes/No
A/A	1.06	1.318	No
B/B	0.06	1.318	No
C/C	0.22	1.318	No
D/D	1.28	1.318	No
A/E	1.453	1.318	Yes
A/D	2.66	1.318	No
A/C	0.89	1.318	No
B/E	1.509	1.318	Yes
B/D	1.28	1.318	No
B/C	1.362	1.318	Yes
C/E	1.565	1.318	Yes
C/D	1.39	1.318	Yes
Reject = null hypothesis is invalid			

Discussion

There were no organisations with an informal management system (score D or below) that achieved an above average standard of physical control (score B or above). However, 26% of the organisations had a formalised management system (score B or above) and did achieve above average standards of physical control (score B or above).

Only two organisations scored A for the highest standards for risk control and A for effective implementation of management systems, and both had a formalised internally and externally verified management system (either BS 8800/OHSAS 18001 and ISO 14000 Certification). In addition, both organisations were subject to external verification of all aspects of their activities by organisations such as the Federal Drug Administration (FDA).

Four organisations had poor standards of risk control (score D/E) and all of these had a limited management system, if at all (score D/E).

The results indicate that those organisations which had a formalised management system achieved better standards of risk control; and conversely, those organisations with limited or no management system had the lowest standards of risk control.

4.1.3 Conclusion

The statistical analysis supports the hypothesis that organisations with formalised health, safety and environmental management standards are more likely to achieve higher standards of physical control than those with no or informal management standards. There is a statistically significant correlation between each of the two axes of formalised management system and physical control of risk. This statistically negates the possibility that the results were measuring a spurious correlation and that the true correlation was between other factors, such as management personality and zeal.

4.2 Significance Review

This stage of the research aimed to develop a methodology to enable an organisation to quantify and rank relative health, safety and/or environmental hazard topics according to the scale of the risk and the effectiveness of the existing control measures in place. This could then be used to establish a priority action plan.

This was achieved by developing a single numerical score for each separate health, safety and environmental topic. Three versions of this methodology were developed, tested and modified over a three-year period, until the final version (version four) was established to be robust and effective.

The first version of the significance review mechanism selected major health, safety and environmental topics and used a comparison with UK legislation to develop a rating system dependent on the extent of non-compliance.

The first version of the significance mechanism was developed to assess an organisation's activities under three separate operating conditions, shown below:

Normal - 'standard' running plant operating conditions including the normal variations that may be expected as part of day to day running but would not be considered to be of incident status;

Abnormal - shut down and maintenance stoppages including weekends and scheduled periods;

Emergency - 'incidents' that may be predicted for the operational area under consideration. Incident scenarios proposed by process personnel and, where applicable, based on past incidents.

4.2.1 Significance Review Version One

The initial significance review was designed to be completed in three stages:

A1 **Preliminary Screening Procedure**

This procedure should be applied to each operational area in relation to the preliminary screening procedure.

A 2 **Normal and Abnormal Operating Conditions**

It is intended that this will allow an overall assessment of the detailed health, safety and environmental issues during normal and abnormal operating conditions.

A 3 **Emergency Operating Conditions**

This part of the assessment is for emergency conditions.

The final stage then required A2 and A3 to be combined to establish the overall health, safety and environmental priorities, and a register of significant effects produced. Examples of each of these three stages are illustrated in figures:

- Stage A1 in figure four-two;
- Stage A2 in figure four-three; and
- Stage A3 in figure four-four.

4.2.1.1 Stage A1: Preliminary screening procedure

Part A1 required a series of questions to be answered for the topics in each operational area, which would act as the preliminary screening procedure for the evaluation of significant effects. The questions identified the criteria below, which would either eliminate the topic at this stage as "not significant" or include it for further review. The screening factors included the following questions:

a) Has there been an accident, near miss or case of occupational ill-health relating to this issue?

b) Has there been a history of complaints in relation to the issue area?

c) Does the law regulate the issue?

d) Is this a major activity?

e) Is there sufficient information available to pass on to the next level of investigation?

If any hazard topic answered YES to one or more of the above questions, the topic was identified as one of "high" significance," and the questionnaire in parts A2 and A3 were triggered.

A1 Preliminary Screening Procedure

The following procedure should be applied in each operational area in relation to each of the issue areas as the preliminary screening procedure for the evaluation of significant effects.

I. 1 Apply the following questions to each issue area at the scale of investigation under consideration (whole plant, operational area, area sub- division etc.)

1.1.1. Has there been a accident, near miss or case of occupational ill-health relating to this issue?

1.1.2. Is there a history of complaints in relation to the issue area?

1.1.3 Does law regulate the issue?

1.1.4 Is this a major activity?

1.1.5 Is there insufficient information available to pass on to the next level of investigation?

1.2 If the answer to any of the questions in part 1 is YES then the issue should be considered of "high" significance.

1.3 If the answer to all the above questions is NO then the significance assessment procedure in 2.0 should be followed.

Figure 4- 2 Example of Stage A1 Proforma

4.2.1.2 Stage A2: Normal and abnormal operating conditions

Stage A2 classified each hazard topic, from stage A1, into three rating categories for normal and abnormal (shutdown) operating conditions:

Not significant, or

Low significance, or

High significance.

A 2 PART A SIGNIFICANCE ASSESSMENT PROCEDURES

The emphasis of this methodology is that it is "task" focused. This will allow an overall assessment of the principle health, safety and environmental hazard topics. The initial objectives of the HS&EMS will incorporate the need to focus in further and assess the health, safety and environmental aspects on different elements (or even single items of machinery) within the operational areas selected for this evaluation.

Environment	Health	Safety
Solid waste	Manual handling	Machinery
Liquids emissions	Noise	Electrical
Air emissions	COSHH	Internal transport
Energy		Slip/trip/fall
Noise		Fire
Raw materials		

Continued/

An example of the type of factors is given below:

A 2.1 SOLID WASTE GENERATION

Assessment criteria - quantity generated, percentage recycled, hazardous content

No significant waste generation (less than one 50 litre wheelie bin per week)	0.5
More than 50% of waste produced is recycled/reused	1
Small quantities of special/hazardous waste produced (less than one 50 litre wheelie bin per week)	2
Some waste recycling/reuse but less than 50%	3
Regular significant quantities of special hazardous waste produced	4

More than one category may be appropriate. Sum the scores.

Totals			
	1	=	Not significant
	2/3	=	Low significance
	>3	=	High significance

A 2.2 ATMOSPHERIC EMISSIONS (including dust and odour)

Assessment criteria- legal control, capture of emissions

No direct atmospheric emissions possible	1
Irregular/ periodic non - LAAPC emissions	2
Non LAAPG emissions but constant/frequent	3

More than one category may be appropriate. Sum the scores.

Totals			
	1	=	Not significant
	2	=	Low significance
	3	=	High significance

A 2.3 WATER USAGE

Assessment criteria- quantity (process usage)

"Domestic" type water use	1
Process usage - periodic and/or small quantities	2
Non-process use but significant use for washing down	3
Process usage - frequent / continuous	4

More than one category may be appropriate. Sum the scores.

Totals			
	1	=	Not significant
	2/3	=	Low significance
	>3	=	High significance

Figure 4- 3 Example of Stage A2 Proforma

4.2.1.3 Stage A3: Emergency operating conditions

Stage A3 classified each hazard topic, from stage A1, into rating categories for emergency conditions. For emergency conditions i.e. worst case scenarios, the assessments were then combined with another set of criteria (see following example).

A 3 EMERGENCY OPERATING CONDITIONS

For normal and abnormal operating conditions the assessment in stages A1 and A2 should be applied in isolation. For emergency conditions i.e. worst case scenarios, the stages A1 and A2 assessments should be combined with the following likelihood evaluators to give an overall value of significance:

Operational area			
Operating condition	Emergency		
	Yes	Partial	No
Is a written procedure available for the process activity?			
Is the process activity totally contained?			
Are emergency procedures in place?			
Describe the frequency of the process	sporadic	frequent	continuous
Is the effect frequently monitored?			
Is there an absence of past incidents?			
Is there an absence of complaints?			
Column Totals			
Grand Total			

Scoring

Yes	=	1 point
Partial	=	2 points
No	=	3 points

Total scores of:

18 or more	=	high likelihood
10-17	=	medium likelihood
less than 10	=	low likelihood

Figure 4- 4 Example of Stage A3 Proforma

4.2.1.4 The combination of the factors from stages A2 and A3

To obtain the final significance assessment, the factors from A2: the normal and abnormal operating conditions, together with A3: the emergency conditions, were combined.

Stage A2: Normal and abnormal operating conditions		Stage A3: Emergency conditions		Combined assessment
Not significant	×	Any likelihood	=	not significant
Low significance	×	low likelihood	=	not significant
Low significance	×	medium / high likelihood	=	low significance
High significance	×	low likelihood	=	low significance
High significance	×	medium / high likelihood	=	high significance

	Action Required
High Significance	Those topics identified as "High significance" were the highest level of priority in terms of actual or potential impact and would be the priority areas for address by the operational and improvement elements of the HS&EMS.
Low Significance	Those topics identified as "Low significance" areas were recognised as having the potential to cause some impact but were not of sufficient scope or severity to warrant a "High significance" rating. Aspects classified as being of "Low significance" would not be currently addressed under HS&EMS improvement programmes or operational controls. It is however, recognised that those aspects may become actionable items and would be monitored during the review of the improvement programme.
Not Significant	Those topics identified as "Not significant" areas were those aspects identified as being either irrelevant in a particular area or being of extremely low incidence or impact. It was not envisaged that HS&EMS improvement programmes or operational controls would address "Not significant" aspects.

Figure 4- 5 Example of Final Proforma Combining Stages A2 and A3

4.2.1.5 Compilation of the significant aspects registers

The results of the significance assessments of both direct and indirect health, safety and environmental aspects will be recorded in a control document. Details relating to the "high significance" areas were recorded in the register entries.

Supporting notes relating to 'low' and `not significant' areas were recorded in the Effects Evaluation file.

4.2.1.6 Action plan

A prioritised action plan was prepared from the above stages.

4.2.2 Significance Review Versions 1 to 4

The first version of the significance review pro-forma was trialed and modified. Each subsequent version was also tested and the results evaluated to determine its effectiveness. The trials of each subsequent version together with the conclusions and modifications for the next version are summarised in table four-three. The final version (four) is detailed in 4.2.3.

Table 4- 3 Conclusions from the Trials of the Significance Review

Organisations used in the trial	Version One
A pharmaceutical company employing 600 (Astra Zeneca plc) An electronics company employing 2,200 (Sony) A major engineering company employing 5,000 (Rolls Royce plc)	**Conclusions of the trial:** The initial review section scored almost all topics as "significant" for any major industrial activity. This was because the score for emergency conditions meant that many topics then scored as "High significance," even though standards were high and, in the main, compliant with minimum legal standards and therefore the score for the potential for loss, was high when control was acceptable. **Discussion** Because of the issues above, prioritising was not possible, thus limiting the practical advantage of an initial significance review. **Modifications undertaken for the version two** The whole system was reviewed and changed. The 'scoring' factors (amount and legislation etc.) were replaced with 'weighting' factors, namely: Significance Control Business Risk These factors were used for normal and abnormal production. Emergency situations were no longer considered. Continued/

Organisations used in the trial	Version Two
A pharmaceutical company employing 600 (Astra Zeneca plc), A major engineering company employing 5,000 (Rolls Royce plc)	**Conclusions of the trial:** The key finding of this trial was that: The scoring factor system worked well with the following limitations: 1. What do you do with topics that do not apply? E.g. hand arm vibration. 2. The weighting was inappropriate because the business factor dominated. 3. How do you establish control for non-legal standards such as energy usage? **Modifications undertaken for the version three** Version three was substantially unchanged except that the weighting matrix was redesigned to improve the balance between the topic priorities. This weighting was adjusted to lessen the significance of the business factor and balance this factor with the other factors.
Organisations used in the trial	Version Three
Version three was evaluated by revisiting the data obtained from version two	**Conclusions of the trial:** The results gave a more realistic balance of priority topics, however, minor adjustments to the prioritisation score were required to fine tune the balance. **Modifications undertaken for version four** Version four uses the same approach as version three, but this time using the weighting factors used in version two. However, the weighting outcomes were adjusted to use the terminology of High, Medium and Low rather than High, Low and Not, as previously, because 'not' implies no issue when there may be residual risk. Additionally, the format and style of the significance review forms was subject to evaluation by those individuals (specialist and non-specialist) who undertook the significance review process. Analysis was then undertaken of the completed evaluation forms and modifications made in response to these comments. Continued/

Organisations used in the trial	Version Four (Final)
A recalculation of previous significance review trials using the version four factors, then: Tested at a major engineering company employing 5,000 (Rolls Royce plc); and a pharmaceutical company employing 600 (Astra Zeneca plc)	**Conclusions of the trial:** This trial indicated that the significance review achieved the original purpose specified in the methodology, when tested with non-professionally qualified personnel from the trial organisations. Competent health, safety and environmental practitioners then independently tested the final draft integrated significance review. A modified factor scoring system was also trialed using factors of thirty for the severity factor, forty for the control factor and fifty for the business risk factor. However, this proved to be ineffective when used by both teams because achieving uniformity of weighting using a 0-50 scale was more difficult than the 1-5 scale due to the permutations available. These two trials were held within twenty-four hours of each other to ensure there were no variations of conditions. Additionally, the competent health, safety and environmental practitioners trial was conducted with two separate specialists independently conducting the review and then comparing the results obtained. The proforma style was well received.

4.2.2.1 Analysis of test data

Version four, the final integrated significance review, was tested at two organisations:

1. By non-specialist company personnel using integrated significance review version four proforma; and
2. Independent experts using independent professional judgement (not the integrated significance review).

Table four-four shows the comparison of scores obtained between non-professional company personnel using the integrated significance review and independent professionally qualified personnel.

Table 4- 4 Comparison of Scores

	Topic	**Non-specialist company personnel using the integrated significance review**		**Independent experts using independent professional judgement**	
		Company 1	Company 2	Company 1	Company 2
1.	Contractors	High	High	High	High
2.	Fire	High	Low	Med	Low
3.	Housekeeping	Low	Low	Low	Low
4.	Machinery	Low	Low	Low	Low
5.	Building	Low	Low	Low	Low
6.	Transport	Low	Low	Low	Low
7.	Electrical	Med	Med	Med	Med
8.	HAV	N/a	N/a	N/a	N/a
9.	COSHH	Med	Low	High	Med
10.	Manual Handling	Low	Low	Low	Low
11.	Noise	Low	Low	Low	Low
12.	Energy	Med	Med	Med	Med
13.	Solid Waste	Low	Low	Low	Low
14.	Water Usage	Low	Med	Low	Med
15.	Liquid Discharges	Med	High	Med	High
16.	Raw Materials	Low	Low	Low	Low
17.	Air Emissions	High	Low	High	Low

Table four-five compares the categorisation of each hazard topic by the non-professional company personnel using the integrated significance review and the independent professionally qualified personnel.

Table 4- 5 Results of Significance Review Trials.

	High	Med	Low	N/a
Company 1: Significance Review	3	4	9	1
Company 1: Independent Review	3	4	9	1
Company 2: Significance Review	2	3	11	1
Company 2: Independent Review	2	4	10	1

Company 1

	x_1	y_1	$x_1 - y_1$	$(x_1 - y_1)^2$
High	**3**	**3**	**0**	**0**
Medium	**4**	**4**	**0**	**0**
Low	**9**	**9**	**0**	**0**
N/a	**1**	**1**	**0**	**0**
Σ				**0**

Company 2

	x_1	y_1	$x_1 - y_1$	$(x_1 - y_1)^2$
High	**2**	**2**	**0**	**0**
Medium	**3**	**4**	**-1**	**1**
Low	**11**	**10**	**+1**	**1**
N/a	**1**	**1**	**0**	**0**
Σ				**2**

Calculation.

Formula

$$R = 1 - \frac{6 \Sigma (x_1 - y_1)^2}{n(n^2 - 1)}$$

Calculation: Company 1

$$\frac{6 \Sigma (x_1 - y_1)^2}{n(n^2 - 1)} = \frac{6 \times 0}{17(289-1)} = 0 \quad R = 1 - 0 = \mathbf{1.00}$$

Calculation: Company 2

$$\frac{6 \Sigma (x_1 - y_1)^2}{n(n^2 - 1)} = \frac{6 \times 2}{17(289-1)} = 2.45 \times 10^{-3} \quad R = 1 - 2.45 \times 10^{-3} = \mathbf{0.98}$$

These results demonstrated that there was a statistically significant correlation of 1.0 for Company 1 and 0.98 for Company 2 between the results obtained from the significance review methodology and that of the independent review for each trial.

The version four integrated significance review tool is accurate for use by non-professional company personnel.

Sensitivity Analysis

A simple relationship was established to show that 3S ×4C × 5BR = 60. Using this relationship the accuracy of the weighting system can be determined. If the weighting factor is changed by 1 unit: [(3**61**S) ×(4**61**C) × (5**61**BR)] = 60, the accuracy of the final weighting will vary by the percentages shown in table four-six. The conclusions of this sensitivity analysis are contained in table four-seven.

Table 4- 6 Calculation of simple sensitivity analysis

Unit Change in Severity (S) factor								
S	C	BR	Weighting	Category	(S-1)	New Weighting	Category	Change in Category
1	1	1	1	L	1	1	L	0
2	2	2	16	L	1	4	L	0
3	3	3	27	M	2	27	L	-1
	4	4	48	H		36	M	-1
		5	60	H		40	M	-1
Unit Change in Control (C) factor								
S	C	BR	Weighting	Category	(C-1)	New Weighting	Category	Change in Category
1	1	1	1	L	1	1	L	0
2	2	2	16	L	1	4	L	0
3	3	3	27	M	2	18	L	-1
	4	4	48	H	3	36	M	-1
		5	60	H		60	H	0
Unit Change in Business Risk (BR) factor								
S	C	BR	Weighting	Category	(BR-1)	New Weighting	Category	Change in Category
1	1	1	1	L	1	1	L	0
2	2	2	16	L	1	4	L	0
3	3	3	27	M	2	18	L	-1
	4	4	48	H	3	36	M	0
		5	60	H	4	48	H	0

Table 4- 7 Results of Sensitivity Analysis

Unit change in a single factor	**+/-% accuracy**
If the Severity (S) factor is changed by one unit then 3/5 of the categories are changed.	+/- 60%
If the Control (C) factor is changed by one unit then 2/5 of the categories are changed.	+/- 40%
If the Business Risk (BR) factor is changed by one unit then 1/5 of the categories are changed.	+/- 20%

4.2.2.2 Discussion of results

The sensitivity analysis indicates that, in particular, the severity factor can dramatically influence the overall outcome of the weighting. On first examination, this over-sensitivity to one factor would appear to be a fundamental flaw in the methodology for the significance review.

It was possible to develop a weighting system, which has been de-sensitised by introducing further sub-scales. For example, categorising by a multiple of thirty for the severity factor, forty for the control factor and fifty for the business risk factor, so that no one single factor would have such significant change. If altered by one unit this would reduce the maximum error to approximately 6%. In practical terms, the results between the non-specialist and professionally qualified staff using these increased sub-factors, caused more variations and points of confusion when selecting the appropriate criteria, thus negating the advantages of de-sensitising the scoring factors.

Table four-five indicates that despite this over-sensitivity, when the methodology was tested between professionally qualified personnel and non-specialist personnel, little difference in the scores was determined. Providing this is reproducible and acknowledging that the results are subject to significant sensitivity, in practical terms, this potential weakness was not observed in the trials.

An unforeseen and beneficial use of the initial significant review in the methodology was that it could also be used as a "weighting" factor to prioritise individual topic areas as part of the risk assessment and audit methodologies. In addition it could be used as a risk underwriting mechanism for organisations such as insurance companies etc. It was apparent that, although this aspect was not central to the research, the significance review could be further developed and extended into other fields.

4.2.3 Final Significance Review: Version Four

An example of the final version (four) of the significance review is illustrated in figure four-five. The weighting for each of the separate health, safety and environmental topics is determined as illustrated in figure four-five.

Severity of Outcome (S)		*Degree of Control (C)*		*Business Risk (BR)*	
Minor injury, short term ill health, minor environmental impact	1	Best practice standards	1	Limited impact if worst case scenario	1
Major injury ill health causing loss of at least 1 week, damage to species such as fish poisoning	2	Meeting legal compliance with full management and documentation	2	Limited effects, no production loss, limited local publicity	2
Death/permanent ill-health or significant species damage	3	Meeting legal compliance with limited documentation or systems	3	Short term loss (loss of weeks) Enforcement Notice	3
		Below legal compliance	4	Death, damage to production and/or major environmental impact causing adverse publicity and fine	4
				Multiple deaths, significant damage to production causing possible permanent loss and/or major environmental impact causing significant adverse publicity	5
Severity of Outcome (S)		**Degree of Control (C)**		**Business Risk (BR)**	
Significance Factor = (S) × (C) × (BR) =					
Significance Factor		**1-20**	**21-40**	**41-60**	
		Low	**Medium**	**High**	

Continued/

Category	Action required
High	**High Risk:** Have the highest level of priority in terms of actual or potential impact and would be the priority areas to be addressed by the operational and improvement elements of the HS&EMS.
Medium	**Medium Risk:** Have the potential to cause some impact but were not of sufficient scope or severity to warrant a "high" rating. Aspects classified as being medium would not currently be addressed under HS&EMS improvement programmes or operational controls. It is, however, recognised that those aspects may become actionable items and would be monitored during the review of the improvement programme.
Low	**Low Risk:** Aspects which are either irrelevant in a particular area or of extremely low incidence or impact. It was not envisaged that HS&EMS improvement programmes or operational controls would address low significance aspects.

Figure 4- 6 Version Four Significance Score Pro-forma.

This final version of the significance review methodology was incorporated into the overall management standard.

4.2.5 Conclusions

Version four of the integrated significance review tool was acceptable for use by non-professional company personnel. However, each factor, particularly the severity factor has a significant influence on the overall rating. Any errors in allocating the correct category will have a significant effect upon the overall weighting score making the methodology less robust than would be desired. Whilst this was acknowledged as a weakness, it is not considered to be a fundamental flaw in the technique itself.

4.3 Risk Assessment

The aim of this stage of the research was to develop an integrated health, safety and environmental risk assessment methodology. A key feature of the methodology was to determine the balance between health, safety and environmental risk impacts. In addition, the tool needed to be suitable for use by personnel within an organisation without significant prior knowledge of health, safety or environment.

Three versions of this methodology were developed, tested and modified over a three-year period. The first version examined the following questions for each major health, safety and environmental hazard topic:

1. What is the magnitude of the risk?
2. Who or what may be harmed?
3. What are the existing control measures to mitigate the risk?
4. What are the appropriate legal, government guidance, industry practice standards applicable to control this risk?
5. Using the four factors above, is the risk controlled?
6. If not, what action is required?

An example of the first version of the integrated risk assessment pro-forma is given in figure four-seven.

Table four-eight details the development of each subsequent version.

Figure four-eight shows an example of the final integrated risk assessment pro-forma (version three).

Description of area and task being assessed							
Name of Assessor				Date			
Risk	To Whom or What?	Quantities	Existing Control Measures	Standards	Is risk Adequately Controlled Yes/No	If No, Action Required	Priority
Environment							
Air emissions							
Liquids							
Solid wastes							
Energy							
Packaging							
Health							
Noise							
Manual handling							
COSHH							
Radiation							
VWF							
Safety							
Machinery							
Lifting equipment							
Confined Spaces							
Fire							

Figure 4- 7 Example of Version One Risk Assessment Pro-forma.

Table 4- 8 Outcomes of the Trials of the Versions of the Integrated Risk Assessment

Organisations used in the trial	Version One
A pharmaceutical company employing 600; an electronics company employing 2,200; and a major engineering company employing 5,000.	**Conclusions of the trial:** On analysis, this approach was found to be severely limited for three main reasons, namely: **1.** Health and safety is a task-based function whereas the environment usually examines the 'global' situation. For example, when conducting a risk assessment of an engineering workshop, the risk assessments for the environment will examine imputs and outputs of the 'mass balance approach' i.e. raw materials used compared with finished product, emissions to water, land and air. There is little need to consider individual tasks undertaken within the workshop. However, for health and safety risk assessments, each individual task and process needs to be examined and assessed as the risk level may vary considerably between the one task and another, and also within tasks being undertaken within the workshop. e.g. the risk levels between the operation of a power press against the hand assembly of the final component, or the ergonomic risk compared to the machinery safety risk of operating the power press. **2.** The assessors found difficulty in assigning priorities to the remedial actions when comparing short-term risks to humans, against long term effects to the environment. For example, which would take priority: an unguarded, readily accessible part of a machine, or a significant VOC emission, with a global environmental impact? **3.** The proforma gave no assistance to the assessors because of the conflicts in the points above. **Modifications undertaken for version two** The second version developed a method for the partial integration of the risk assessment mechanism for health, safety and environment. This model separated out the health and safety components from the environmental components, however, the model has a similar 'look and feel' to both the common and separate elements. Continued/

Organisations used in the trial	Version Two
An electronics company employing 2,200 (Sony); and a major engineering company employing 5,000 (Rolls Royce plc). The above two trials were conducted both by non-specialist company personnel using the partially integrated risk assessment methodology and proforma and independent experts using professional judgement.	**Conclusions of the trial:** The analysis of the trials led to the following conclusions: A partial integration was possible, however, three limitations were identified: 1. The assessors still found difficulty in assigning priorities to the remedial actions when comparing short-term risks to humans, against long term effects upon the environment, as before. This depended upon the experience and knowledge base of the assessors. 2. The assessors who were more experienced in one discipline tended to over-rate the importance of the discipline in which they lacked experience. This is because they lacked the detailed technical knowledge of that issue and therefore made judgements on the side of caution, possibly for fear of criticism of themselves. 3. Version two of the environmental assessment did not distinguish between the normal operating conditions, shut down and start up conditions, as well as reasonably foreseeable or emergency situations. **Modifications undertaken for the version three** Version three refined version two by adding the methodology of the significance review to the assessment. This enabled the assessors to prioritise the subject in accordance with the previously developed sensitivity factors of: - Business Risk - Severity - Degree of Control At this stage the methodology questioned the use of non-specialist personnel for the risk assessment process. Additionally, the environmental risk assessment associated with the activities at operating units was considered under normal operating conditions, shut down and start up conditions, as well as the realistic potential significant impacts associated with reasonably foreseeable emergency situations. The methodology of version three also amplified the fact that this process is intended to identify significant environmental risks only and is not intended to require a detailed life cycle assessment. Continued/

Organisations used in the trial	Version Three - Final
A pharmaceutical company (Astra Zeneca); an engineering company (Rolls Royce); and a foundry (Howmet).	See Analysis/discussion for details

The final version (three) of the risk assessment is reproduced in figure four-eight.

Page 1 of 2

Integrated Health, Safety and Environmental Risk Assessment Recording Form	
Assessment Number	
Date of assessment	
Name of assessor(s)	
Environment **Description of the Area being assessed**	
Health & Safety Description of the Task being assessed	

Continued/

Integrated Health, Safety and Environmental Risk Assessment Recording Form

Environmental Assessment

Environmental Impact	How May They Occur?	Quantities Involved	Existing Control Measures	Standards Used for Comparison	Is risk Adequately Controlled Yes/No	If No, Action Required	Priority: High Medium Low
Air Emissions Planned							
Air Emissions Fugitive							
Solid Wastes							
Packaging							
Energy Usage							
Visual Impact							
Noise							

Health and Safety Assessment

Risk	To Whom	Existing Control Measures	Standards Used for Comparison	Is risk Adequately Controlled Yes/No	If No, Action Required	Significance factor	Priority High Medium Low
Health							
Manual Handling							
COSHH							
Noise							
Safety							
M/c Safety							
Confined Spaces							

Figure 4- 8 Final Risk Assessment Proforma

4.3.1 Results

The results of the comparative trials where non-specialist company personnel used the partially integrated risk assessment methodology and proforma and independent experts used professional judgement, are shown in table four-nine.

Table 4- 9 Comparison of the Results of the Risk Assessments

	Non-specialist company personnel using the partially integrated risk assessment methodology and proforma		Independent expert using independent professional judgement	
Hazard topic priority rating	Number of topics given priority rating high/ medium/ low			
	Trial 1	Trial 2	Trial 1	Trial 2
High	12	8	7	2
Medium	10	4	21	12
Low	19	8	13	6

4.3.1.1 Analysis

Correlation between the results of the risk assessment conducted by non-specialist company personnel and independent experts demonstrated limited correlation. Trial one had a correlation co-efficient of 0.29 whereas trial two had a correlation co-efficient of 0.92.

4.3.1.2 Discussion of results

The original aim of this stage of the research was to develop a fully integrated risk assessment methodology for use by non-specialist personnel.

Analysis of the results identified a significant flaw in this integrated risk assessment methodology. The purpose of the integrated risk assessment was to enable non-specialist personnel without significant knowledge and expertise to undertake the integrated risk assessment process. However, in practical terms, this did not prove to be

viable because, in order to make a judgement about adequacy of risk control, a direct comparison with legal, governmental, company or best practice standards is required. Assessors lacking detailed technical knowledge either made subjective judgements or they erred on the side of caution, possibly for fear of criticism. Therefore, without knowledge of these standards the assessors were not always able to make objective judgements.

It would be possible to develop a series of detailed standards for non-specialist personnel to use, but they would have to be site specific and the costs of production would probably outweigh the benefits. Alternatively, a multi-disciplined team of appropriately qualified and experienced assessors could conduct the risk assessments.

An additional observation was that the professionally qualified assessors examined a particular topic in far more depth than the questionnaire and the limited experience base of the non-specialist company personnel permitted. For example, the company personnel, using the proforma, superficially examined the earthing arrangements for large volume bulk solvent storage. This was subject to further examination for details of previous earth impedance tests etc. by the risk assessor with professional expertise before determining that the risk was suitably controlled.

It was evident in the early trials that a mechanism to assist the ranking of remedial actions from the integrated risk assessment process was necessary. Although not originally foreseen in the methodology, the use of the initial significance review rating scale was considered. This rating scale had already proved to be an effective method of prioritisation and could be used without adaptation.

The risk assessment methodology could not be developed as a fully integrated system because health and safety risk assessment requires a task-based approach, whereas the environment usually requires a 'global' approach.

A partially integrated risk assessment model was incorporated into the final proposed integrated management standard, which separated out the health and safety components

from the environmental components, whilst retaining some common elements, particularly with the remedial action programme from the assessment process. However, the model had a similar 'look and feel' to both the common and separate elements and is illustrated in figure four –nine.

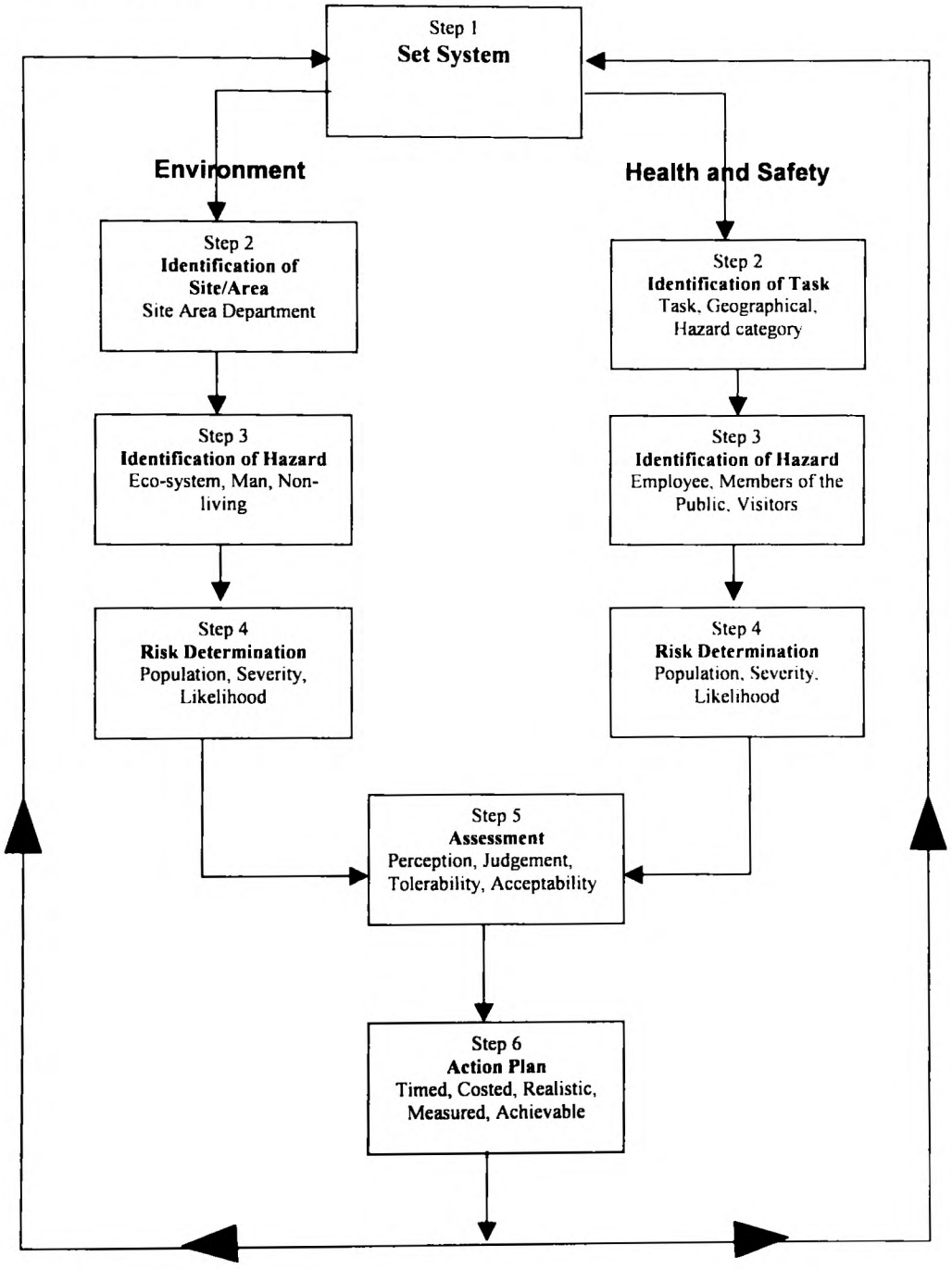


Figure 4- 9 Stages of the Integrated Risk Assessment Process

4.3.2 Conclusions

A full integrated risk assessment methodology for use by non-professional company personnel was not possible, because health and safety risk assessment requires a task-based approach, whereas the environment usually requires a 'global' approach.

A partially integrated risk assessment model was incorporated into the final proposed integrated management standard, which separated out the health and safety components from the environmental components, whilst retaining some common elements, particularly with the remedial action programme from the assessment process. This model had a similar 'look and feel' to both the common and separate elements. The partial integration was possible, although two major limitations were identified:

1. The assessors still found difficulty in assigning priorities to the remedial actions when comparing short-term risks to humans, against long term effects upon the environment.

2. The assessors who were more experienced in one discipline tended to over-rate the importance of the discipline in which they lacked experience.

Integration of the risk assessment methodology was the least successful of any of the supporting tools.

4.4 Audit

4.4.1 Introduction

The purpose of this stage of the research was to develop an integrated audit method for health, safety and environment. The audit methodology had to quantify and rank the relative health, safety and environmental hazard topics according to the scale of the risk and the effectiveness of the existing control measures in place. In addition, the methodology had to be suitable for use by non-specialist company personnel.

Seven versions of the methodology were developed, tested and modified over a three-year period, until the final version (version seven) was established. The initial audit model was designed to provide a quantifiable questionnaire subdivided into two parts:

Part A: the management system; and
Part B: the physical control of health safety and environmental risks.

When the questionnaire was completed, the scoring system gave an overall performance rating of the organisation's health safety and environmental performance, together with individual scores for each element of the management system and individual specific health safety and environmental topics. This enabled organisations to identify and manage strengths and weaknesses in hazard control and the management system.

Version one of the integrated audit pro-forma is shown in figures four-ten and four-eleven.

Details of how each version was developed and modified from the outcome of the trials are detailed in table four-ten.

An example of the final integrated audit pro-forma (version seven) is given in appendix three.

4.4.2 Audit Version One

The questions for Component A relating to the management system were completed and then the individual question scores were summated. This was repeated for Component B and summating A and B obtained an overall quantitative audit performance score.

Element Number	Question	Score				
		1	3	5	N/a	Comment
		No Never None	Some 50% some-times	Yes Alwa ys All		
4.0.1 General	1. Is there an established and maintained EHS management system.?					
4.0.2 Policy	2. Has an initial review been carried out?					
4.1 Policy						
4.1 EHS policy	3. Is the current EHS policy up-to-date?					
	4. Are individual responsibilities clearly set out?					
	5. Does the organisational section of this policy specify the detailed arrangements for the control of specific risks?					
	6. Is there a commitment of the necessary resources required within the policy?					
	7. Are employees aware of the policy?					
	8. Has the organisation's most senior management signed the EHS policy?					
	9. Define the allocation of responsibilities and accountabilities in the management structure.					
	10. Ensure people have the necessary authority to carry out their responsibilities.					
	11. Allocate adequate resources commensurate with its size and nature.					
Number of Not Applicable questions						
Column Total						
Overall score						

Figure 4- 10 An Example of the Audit Questionnaire for Part A: 'Management'

Atmospheric Emissions						
Question	**1**	**2**	**3**	**4**	**5**	**N/A**
	No None Never		Some 50% sometim es		Yes Always All	
Are all process emissions identified?						
Are sources of fugative emissions identified?						
Is regular monitoring of emissions undertaken?						
Are results of air emissions within the environmental targets?						
Are results of air emissions within the permissible consents?						
Have any complaints re nuisance emissions been received since the last audit?						
Are employees informed of the results of these emissions?						
Are members of the public informed of the results of these emissions?						
Are there any projects being considered to reduce emissions?						
TOTAL						

Figure 4- 11 An Example of Audit Questionnaire for Part B: 'Air Emissions'

4.4.3 Audit Testing Versions One to Seven

Table 4- 10 Outcomes Following the Trials of the Versions of the Integrated Audit

Organisations used in the trial	Version One
The Salvage Department of electronics/engineering company (Sony). Trial undertaken by the author and a team of professionals from the company	**Conclusions of the trial** In principle, the integration audit concept worked and was viable, however, substantial development was required, as detailed below: 1. The scoring system required modification because: - the number of questions asked within each topic will influence the importance of that topic within the overall score, creating a bias in the scoring system; and - the audit did not rank the individual topics according to their potential for loss e.g. housekeeping versus fire and explosion risk. The introduction of a weighting factor would solve this problem. 2. Some of the Part B audit questions were not measurable. In version one the Part B questions included some details of the management system, which were more appropriate in Part A. An example of this was the solid waste, which included questions on policy. 3. The questions were not detailed enough for non-specialists to make adequate judgements against standards. Consideration needed to be given to supporting the questions with some formal indicative criteria for non-specialists to use. 4. The proformas had no space for the addition of a process description by the auditor, as required for Part B. **Modifications undertaken for version two** To overcome the limitations identified above, a weighting factor was developed for each of the various health safety and environmental topics being examined. The purpose of the weighting factor was to weight the outcome of each of the topics to reflect their relative potential loss to the organisation. The new weighting factor would relate quantity (how much), frequency (how often) and any minimum legal standards to each hazard topic in Part B and would enable a category of high, medium or low to be assigned to this topic. The category would then act as a multiplier to the overall topic audit score, enabling the importance of each topic to be established relative to one another. Additionally, an adjustment for the number of topic questions was developed. Continued/

Organisations used in the trial	**Version Two**
Repeat of trial 1 at the Salvage Department of electronics/engineering company (Sony).	**Conclusions of the trial** The weighting factor worked in principle, identifying the relative importance of hazard topics to the organisation. However, the majority of topics were highlighted as significant, usually because the topic was controlled specifically by legislation, which was a key factor in the calculation. The wording of the questions was much clearer, with the ambiguities between Parts A and B of the questions having been removed. The mathematical adjustment for the number questions was effective. **Modifications undertaken for version three** Further work was undertaken to develop the weighting factor.
Organisations used in the trial	**Version Three**
Engineering company (Sony) Pharmaceutical company (Astra Zenica) Cosmetics manufacturing (L'Oreal) These trials were conducted in two phases, the first phase completed by a non-professionally qualified member of staff using the pro-forma. The second phase completed independently of the pro-forma by professionally qualified member of staff. The results of both phases were then compared.	**Conclusions of the trial** The modified weighting factor did not work because: 1. The scoring system was not sufficiently sensitive to magnify the significance of potential loss where standards of risk control were already high (Astra Zenica) 2. Almost all the topics scored 'significantly' at Astra Zenica because of the nature of the site's potential risk. This was a health and safety top-tier COMAH site and subject to Environmental Protection Act Part A. This trial identified that whilst issues that may be of 'significance' to the company in terms of compliance with legal standards, the business risk was more critical because if they were not able to produce, through fire or regulatory enforcement, then the loss to business outweighed any other factor. For example, using this weighting factor the topic of manual handling achieved the same score as fire and explosion. However, in practical terms, the cost of a manual handling injury was insignificant in comparison to the cost of losing a vat of an anti-cancer pharmaceutical from fire or explosion. The value of such a drug may be measured in millions of pounds and additionally this company is the main supplier in Europe. The conclusion of this trial was that the existing significance factor was incorrect. **Modifications undertaken for version four** A new significance factor needed to be developed which used a scale of sub-factors such as severity, risk control and business implications. At this stage it was realised that the significance review calculation (chapter 4.2.3) could be applied after modifying it to include the business factor. Continued/

Organisations used in the trial	**Version Four**
Pharmaceutical company (Astra Zenica) Cosmetics manufacturing (L'Oreal)	**Conclusions of the trial** The addition of a business significance factor to the audit weighting/significance review factor was of benefit. **Modifications undertaken for version five** The audit-weighting factor was developed further to refine the balance between the potential severity, risk control and business factor.
Organisations used in the trial	**Version Five**
Engineering company (Rolls Royce) Pharmaceutical company (Astra Zenica)	**Conclusions of the trial** The audit proforma was improved, however, the scoring system was ineffective when part B topic sections, e.g. hand arm vibration, were not applicable. No allowance had been made in the scoring system for 'not applicable' topics. Auditors were not able to objectively determine the control standards as part of the audit weighting factor calculation where there were no legal minimum standards to use as a comparison for judgement e.g. energy. This could be overcome by specifying approved company standards. The calculated audit weighting factor identified many part B audit topics as high significance as a result of an over-emphasis on the Business Significance weighting. **Modifications undertaken for version six** A mathematical factor was introduced for part B topics which were 'not applicable' to the audit itself. The business significance weighting was re-calculated to give less emphasis to the business risk component.
Organisations used in the trial	**Version Six**
Paper Exercise	**Conclusions of the trial** The audit proforma proved to be effective, however, two issues were unresolved: 1. Would the methodology still be effective if only selected aspects of the site, rather than the full site, were audited? 2. If the nature of the activity being audited was heavily biased towards one or two of the topics, would the resulting score be biased? **Modifications undertaken for version seven** A trial was planned to test these issues. Continued/

Organisations used in the trial	Version Seven - Final
A full audit was undertaken at part of the plant i.e. the waste treatment plant of a large engineering company (Rolls Royce) These trials were conducted in two phases, the first phase completed by a non-professionally qualified member of staff using the pro-forma. The second phase was completed independently of the pro-forma by professionally qualified member of staff. The results of both phases were then compared.	**Conclusions of the trial** The analysis indicated that the full site should be considered rather than selected parts of the site, as many of the pro-forma questions could not be answered for a part of the plant. Components of the site are often interdependent. It is not practicable to audit the components in individual isolation, e.g. the questions such as visual aspects and waste disposal: do they refer to the part of the plant being audited or to the full site? In practice the questions are designed for the whole site. The analysis indicated that the audit pro-forma would cope if the nature of the activity being audited were heavily biased towards one or two topics. The terminology 'weighting factor' was replaced with 'significance factor' in the draft integrated management standard. The significance factor weighted the main issues and if other issues were not present, the neutral score did not bias the overall rating.

4.4.4 Analysis of Test Data

The last audit trial was undertaken at one company by:

1. non-specialist company personnel using the integrated audit proforma version seven; and
2. independent expert auditors using professional judgement as detailed in chapter 3.2.5

The results of each of the above trials were compared to determine if the same issues of non-compliance were identified by each audit team and if so, were similar significance factors applied?

The non-specialist company personnel were asked to apply the questions contained in the integrated audit proforma. Both to the calculation of:

- The significance factor of either high, medium or low, using the methodology of the significance review. The results obtained are detailed in column three of table four-eleven, and
- The percentage compliance with the specific audit questions for each of the seventeen topics of physical control. The results obtained are detailed in column two of table four-eleven.

The independent auditors were asked to identify for each of the seventeen Part B: 'The physical standards of control of health, safety and environmental topics', if any of these topics were in the auditor's opinion of particular significance to the business. i.e. where loss of control for any reason would have a significant impact upon the organisation against a subjective judgement of the standard of compliance. The independent auditors used the criteria given in table three-two to categorise their judgement of the control of risk.

The results obtained by the independent auditors are detailed in table four eleven. Column four lists the subjective judgement of the standard of compliance and column

five lists the topics that were in the auditor's opinion of particular significance to the business.

Table 4- 11 Comparison of Audit Trial Results

Topic	**Non-specialist company personnel using the integrated audit proforma**		**Independent experts using professional judgement**	
	Score as a % of maximum	Significance Factor	Subjective performance score	Significance Factor
1 Contractors	89	Medium	B	Medium
2 Fire	89	High	A	High
3 Housekeeping	86	Low	B	Low
4 Machinery	89	Low	A	Low
5 Building	100	Low	B	Low
6 Transport	96	Medium	B	Medium
7 Electrical	100	Medium	A	Medium
8 HAV	N/A	N/A	N/A	N/A
9 COSHH	86	Medium	B	Medium
10 Manual Handling	92	Low	B	Low
11 Noise	100	Low	A	Low
12 Energy	100	Low	B	Low
13 Solid Waste	100	Low	A	Low
14 Water Usage	96	Medium	B	Medium
15 Liquid Discharges	100	Medium	A	Medium
16 Raw Materials	100	Low	B	Low
17 Air Emissions	89	high	B	High

The results given in table four-eleven for both the independent auditors and the audit pro-forma identified the same 'high' significance factor topics to this organisation. Whilst the results for the comparison of identified significance factors indicated a full correlation (1.0) personnel using the audit pro-forma scored the compliance of each topic higher than the independent auditors.

Analysis of this difference indicated that the independent auditors, with their specialist knowledge, were able to examine the topics in more depth than the audit pro-forma

questionnaire. For example, within Part B: Fire/ Explosion, the questions required the non-specialist company personnel to examine the arrangements for fire precautions in general terms only. The independent auditors were able to examine the issues of sizing of pressure relief, bursting disk pressures, explosion relief panel over pressure settings etc. of the pressure vessels. None of these topics were covered by the audit pro-forma questions on fire/explosion.

Without the specialist professional knowledge, the pro-forma question allows only a superficial (system level) examination of the physical standards e.g. 'Are there earthing checks conducted on a regular basis? Yes/No'. It does not ask whether they meet the appropriate standard, or review whether that standard is still relevant. It would be possible to design a series of questions which would examine the physical performance of a particular topic against the standard. These questions would need to be very detailed and only relevant to the site being audited. For these reasons, it is considered that advantages of such a system would not be proportionate, because of the cost of producing such a detailed audit questionnaire for each individual site.

If professionally qualified staff were used for the audit, it would not be necessary to develop a detailed pro-forma questionnaire. Their professional knowledge would permit questioning of the compliance to this standard as part of the audit process. Without the development of detailed standards for non-specialist personnel, the audit purpose:

> 'to examine and evaluate audit evidence to determine whether an organisation's system conforms to standards,'

can only be achieved by a professional with knowledge and experience of the standards.

Another factor that may lead to imbalance, even when using professional auditors, is that there is a noticeable bias towards the specialist's own discipline. For example, the environmentally biased professional auditors spend a disproportionate time examining environmental issues compared to health and safety, and vice versa. Therefore, even

when using professionally competent staff there will always be a need for team auditing with the team members having a clear spread of knowledge across both disciplines.

When issues such as ergonomics or loss of containment were not covered by audit pro-forma, then the non-specialist company personnel were not able to identify the potential risk. The personnel may become over reliant on the audit pro-forma and overlook a significant health, safety or environmental risk through lack of technical competence.

4.4.5 Conclusions

The most significant findings of the trials were that:

1. Without the specialist professional knowledge, the pro-forma question allows only a superficial (system level) examination of the physical standards of control specified by the proforma. If professionally qualified staff are used then the detailed pro-forma questionnaire is an administrative tool and a format for recording the audit outcomes.

2. When using professionally competent staff, there is always a need for team auditing to prevent specialist bias. This requirement was subsequently built into the audit requirement of the proposed integrated management standard.

4.5 Integrated Management Standard

4.5.1 Introduction

The aim of this stage of the research was to develop a draft integrated health, safety and environmental management standard. The initial framework for an integrated standard had been previously developed and tested (Newbury 1997), and a questionnaire had established that organisations were in favour of the concept of such an integrated system. However, the existing framework contained little detail with regard to the means of implementation. To provide this detail, methodologies for significance review, risk assessment, and audit, together with detailed appendices for policies, communication, training, and performance measurement were developed and tested.

Figure four-twelve represents a diagrammatic model of the proposed integrated management standard. This diagram visually represents the primary cycle of policy, planning, implementation and review, detailed in the proposed integrated management standard. Together with the secondary cycle of significance review, risk assessment, audit, communications and training. The secondary cycle is contained within the annex of the proposed integrated management standard (chapter 5) and is repeated at far more regular time intervals than the primary cycle.

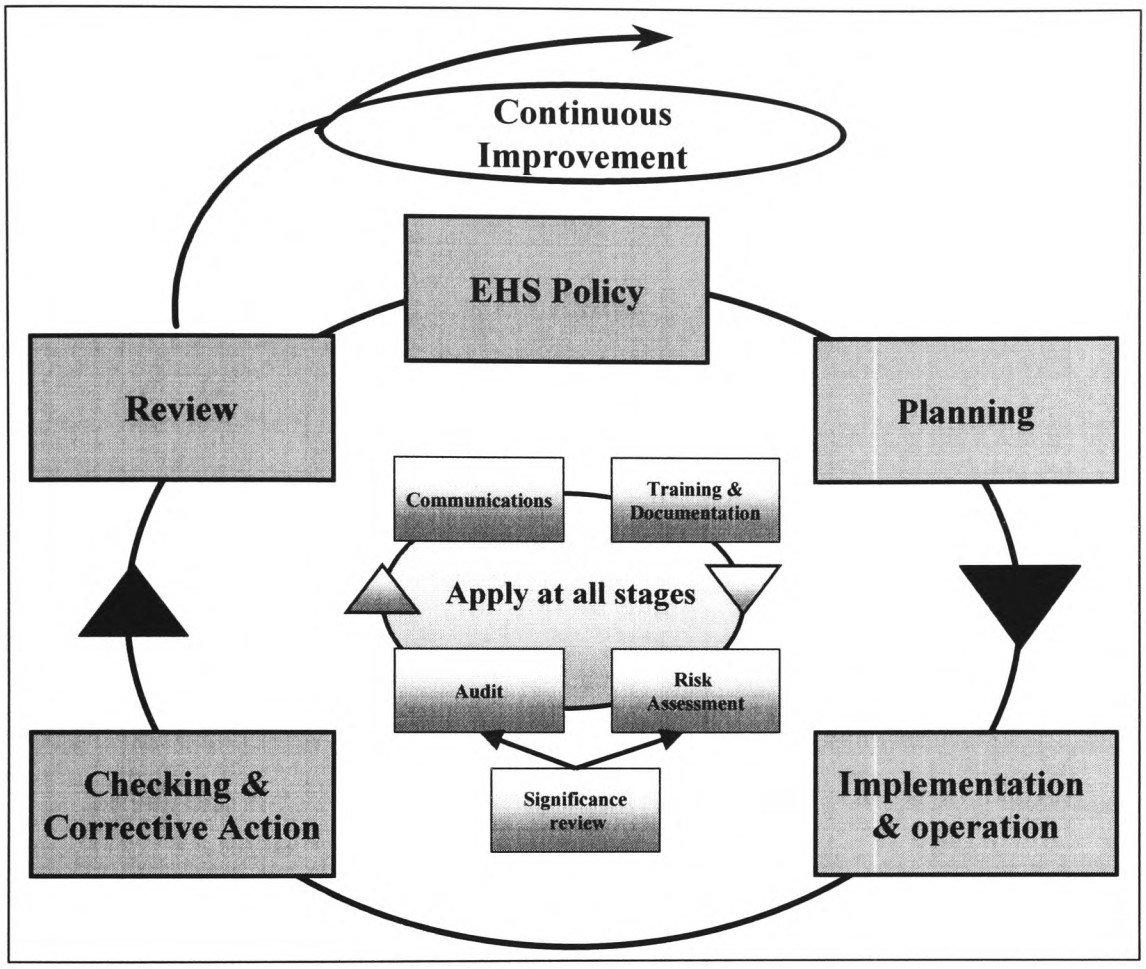


Figure 4- 12 A Diagrammatic Model of the Proposed Draft Integrated Management Standard

The final standard was partially tested with three trials undertaken at a pharmaceutical company (Astra Zenica) and two engineering companies (Rolls Royce and Hills Industries). Additionally, a limited trial of a service organisation was undertaken (Sainsbury's retail food). Whilst the organisations were willing to allow testing of some elements of the system, they were not prepared to commit significant resources and time to fully implement an unproven system.

It should be noted that at an early stage of the trial of the proposed integrated management standard in the retail organisation, it was evident that the proposed standard was of limited benefit because benefits did not outweigh the costs, in that:

1. There were limited health, safety or environmental risks to justify the resource requirement of implementing this standard

2. There were limited topics that were relevant, particularly in terms of environment for which the relevant topics were mainly packaging and energy usage, which was not in the control of the local management

3. The local store management had limited control of the store and was heavily directed from the centre. Therefore a management standard would have to apply across in excess of 1,000 stores before it would be effective.

For the above reasons, it was determined that this proposed standard was inappropriate for a retail environment and this finding confirmed the selection criteria specified in chapter 3.2.4.

4.5.2 Analysis and Discussion of Results

The methodologies for integrated significance review, risk assessment and audit had been previously tested, so the trials concentrated upon testing the management standard itself. The elements tested are detailed in table four-twelve.

Table 4- 12 Elements of the Draft Integrated Management Standard Tested

Section of the management standard trialed within the organisations detailed below	**Organisations used in the trial**
Policy Section	Large multi site engineering site (Rolls Royce)
Implementation Section	Single site engineering process, with significant H, S & E potential (Hills Industries)
Review Section	Large multi site engineering site (Rolls Royce)
Training and Communications Section	Large multi site chemicals manufacturing subject to COMAH and IPPC (ICI/Astra Zenica)
Paper review of all sections	Large multi site service sector (Sainsbury's)

For the draft standard to succeed the following criteria had to be achieved:

1. Fully or partly eliminate or minimise the risk to all stakeholders who may be exposed to health, safety and environmental risks associated with its activities
2. Maintain and continuously improve performance
3. Demonstrate such conformance to others
4. Be easy to implement and use
5. Be suitable for all or specific organisational activities
6. Balance priorities of different major topics of health, safety and environment
7. Meet both National and European legal requirements

When the trials results were collated, they indicated that the effectiveness of the management standard was variable, depending upon the level of use. In practice, the integrated management standard was implemented at five separate levels within an organisation, as detailed in table four-thirteen.

Table 4- 13 The Levels at Which a Standard is Implemented

Level	**Title**	**Example**
1	Policy	The policy will set out the objectives and responsibilities to achieve the desired performance of the organisation.
2	Operating	This will set out the detailed management system and the arrangements across the organisation for such matters as approval of new suppliers of a raw material used in the manufacturing process.
3	Process operation	This will detail how the management system will control a particular process such as the batch manufacturing of a drug.
4	Working instructions	These will give the operator detailed instructions on the particular task in the manufacturing process. The 'cookery book.'
5	Results, forms and procedures	These will detail the process records from the working instructions and may include temperature and weights of additions from the batch manufacture process.

The results of the trials indicated that successful implementation of a management standard was variable and these were summarised in figure four-thirteen.

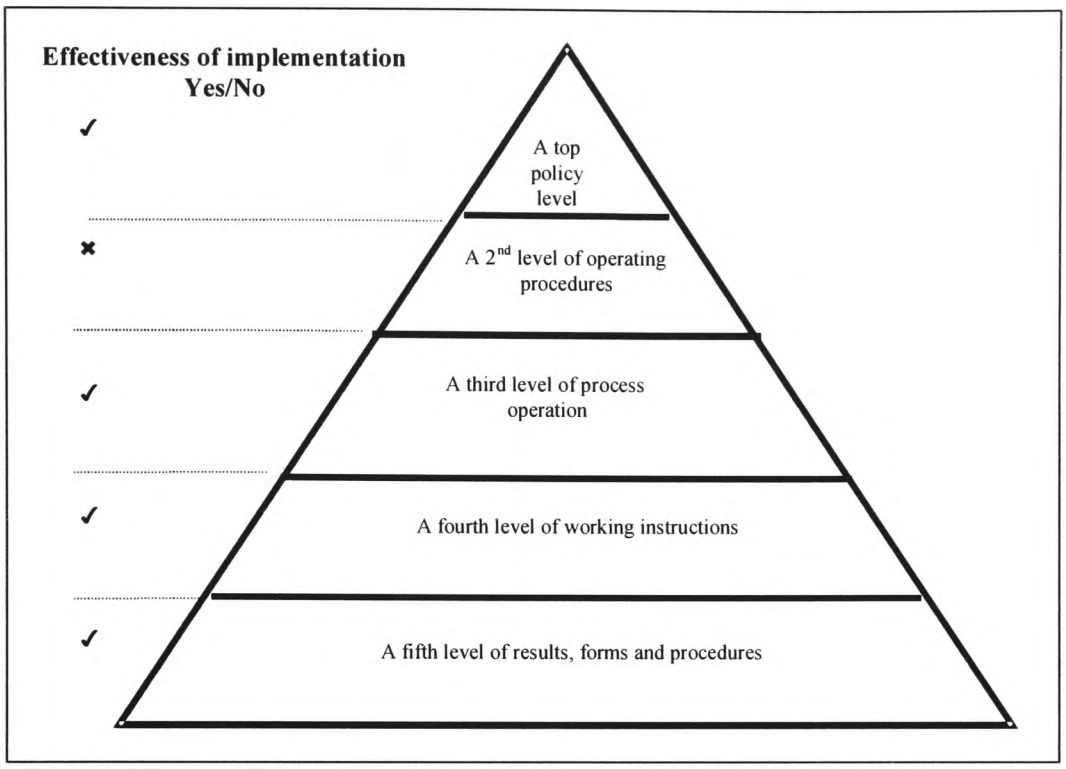


Figure 4- 13 The Advantages and Disadvantages of Implementing the Integrated Standard.

The advanatages and distadvantages at the various levels are detailed below:

Level One: Policy

Top-level integration of health safety and environmental targets and statements was beneficial, it provided a clear management structure and purpose statements. Individual parts of the organisation could refer back to this top-level policy when determining targets and resource spending. However, this left local autonomy with regard to how these policy objectives could be achieved, which allowed for local, regional or national variations. Integration at policy level was particularly favoured by ICI and Astra Zeneca, allowing each national site its autonomy to implement the detail as appropriate.

Level 2: Operating

Level two operational instructions providing the detail of such matters as:

1. The initial significance review;
2. Organisational arrangements;
3. Emergency planning;
4. Integrated risk assessment tool; and
5. The audit protocol.

These topics were contained within the appendices of the draft integrated management standard. The piloted trial data for these specific topics indicate various difficulties in implementation as detailed below with few advantages, specifically:

a) Initial significance review

As discussed in 4.2 there were benefits with the initial significant review in the ability, prior to the introduction of management system, to identify key potential non-conformances. Few disadvantages were noted.

b) Organisational

Clear benefits were identified as procedures could be developed for issues such as:

- Register of legislative and regulatory requirements;
- Integrated product development;
- Development of process;
- Design change etc.

Few disadvantages were noted.

c) Emergency planning

The actions and mitigation's against a health and safety risk were substantively different from that of an environmental risk. Therefore, few advantages were

noted when integrating the emergency procedures, although a similar 'look and feel' procedure aided communications.

d) Integrated risk assessment

As discussed in 4.3 few benefits were noted. The main disadvantage was that the risk assessment methodology could only be partially integrated to provide a similar 'look and feel.' It was not effective for non-professionally qualified staff to undertake.

e) Audit

As discussed in 4.4 few benefits were noted. It was technically possible, but not desirable, to integrate health, safety and environmental audits because it was not practical at this stage for the audit to be conducted by non-specialist company personnel.

Therefore, integration at level two had many difficulties in implementation with fewer advantages.

Level Three: Process operation

At the process level three, integration of health, safety and environment could be achieved. There were some disadvantages e.g. for each process topic separate health, safety and environmental risk and quality control parameters were necessary and whilst they may be contained within one set of instructions they were not truly integrated. For example, in the manufacture of a batch pharmaceutical reaction it would be necessary to consider issues of pressure and temperature for health and safety, and emissions to atmosphere for environmental control. However, there were similarities between each topic. There were also significant advantages for ease of communicating and training operating instructions.

Level Four: Working Instructions

Integration was best achieved at this level. Operating instructions for the manufacture of a particular component could accurately and easily specify health, safety and environmental actions. The reasoning in the instructions gave the operator a better understanding of the direct health safety and environmental effects of the action/operation.

Level Five: Results, Forms and Procedures

At this level integration was technically possible, but had few advantages. For example, health, safety, and environmental data on solvent process emissions is collected by different means and used for different purposes. The health and safety approach would assess employee exposure to that solvent. The environmental data would be used to assess the impact of volatile organic compounds (VOC's) released to the atmosphere, as part of abatement requirements and regulatory consents. The integrated standard allowed for each separate set of data to be collected within the same style and disseminated and controlled within the same system. However, this was the only perceived advantage.

The original criteria identified to successfully implement an integrated management standard were not totally met, as summarised in table four-fourteen.

Table 4- 14 Criteria for Successful Implementation of an Integrated Management Standard.

No	Criteria	Was the criteria achieved?
1	Fully or partly eliminate or minimise the risk to all stakeholders who may be exposed to health, safety and environmental risks associated with its activities	Partly
2	Maintain and continuously improve performance	Yes
3	Demonstrate such conformance to others	Yes
4	Easy to implement and use	No
5	Suitable for all or specific organisational activities	No
6	Balance priorities of different major topics of health, safety and environment	No
7	Meet both National and European legal requirements.	Yes (see 4.6)

There were advantages and disadvantages of using an integrated standard, compared to separate health and safety, and environmental standards. These are shown in table four-fifteen.

Table 4- 15 Benefits of Integration Compared to Separate Management Standards.

Standard and Appendices	Draft Integrated Standard	Separate standards but with same 'look and feel'	
		Health and Safety OHSAS 18000 Series	Environment ISO 14000 Series
Policy and Framework	✓		
Significance Review	✓		
Training	✓		
Communications	✓		
Documentary Control	partly		
Risk Assessment		✓	✓
Emergency Preparedness		✓	✓
Audit		✓	✓
Key ✓	Judged to be most effective and beneficial in comparison to the other listed standards		

4.5.3 Conclusions

The draft integrated management standard met some of the criteria for many organisations and was both beneficial and effective when introduced at four of the five operating levels.

Of the components that were least effective, the risk assessment methodology could be developed into two separate health and safety and environmental appendices each with a similar 'look and feel' to their approach. However, it is unlikely that the integrated audit methodology could work using non-specialist company personnel.

In addition, where the risk potential is relatively low e.g. a service organisation such as retail food, or there is only one significant potential risk topic e.g. the environmental impact of liquid waste discharge at a waste treatment plant, the cost/benefit analysis does not justify introducing an integrated management system.

The observations are based on a limited trial. The effectiveness of the complete draft integrated management standard can only be fully evaluated following complete implementation into a range of organisations.

4.6 European Requirements

4.6.1 Introduction

The aim of this stage of the research was to determine whether the draft integrated management standard met the requirements of both the European Union Member States national legislation (May 2000) and existing management standards for occupational health and safety, and environment. Therefore, during 1998 and 1999 each of the European Union Member States was contacted either directly or through European co-ordinating organisations such as the European Agency for Safety and Health at Work; the European Environment Agency; Directorate General DG V and Xl; the International Standards Organisation; and the International Labour Organisation. As a result, the legal requirement for both occupational health and safety and environmental management standards within each member country was established.

A comparison was undertaken of the established member states national legislation requirements against the proposed integrated management standard.

4.6.2 Health and Safety

All member states are required to introduce national laws to implement the requirements of the European Council Directive of 12 June 1989, on the introduction of measures to encourage improvements in the safety and health of workers at work. This is known as the Framework Directive (89/391/EEC). This Directive requires the member states to promote a steady improvement in working conditions, allowing risk control standards to be harmonised while maintaining progress. This Directive, based on Article 118A of the Treaty, pursue this aim by laying down minimum requirements.

The framework directive obliges the employer to plan, organise, control, monitor and review health and safety arrangements. However, there are no general legal requirements to adopt a specific formalised management system, with the exception of EU Directives addressing specific industries or activities, usually high risk. For

example, Annex III of the European Directive 96/82/EC on the Control of Major Accident Hazards Involving Dangerous Substances (the Seveso II Directive, COMAH) requires a safety management system for certain specific major risk industries or activities. The safety management system of a high risk COMAH site should include, as part of the general management system, the organisational structure, responsibilities, practices, procedures, processes and resources for determining and implementing the major accident prevention policy.

All European Union member countries have now implemented the Framework Directive. As a result of the principles contained in the Framework Directive or in specific specialised directives, individual Member States, within the European Union, have developed voluntary occupational health and safety management systems.

4.6.3 Environment

Information from the European Commission of the 18 June (European Environment Agency. 1999b) shows that the following community directives have been fully implemented into member states' national legislation:

1. Directive 82/501/EEC – the "Seveso" directive – concerning the prevention of major industrial accidents;

2. Directive 96/61/EC - Integrated Pollution Prevention and Control (IPPC); and

3. Regulation (EEC) No 93/1836 - Allowing voluntary participation by companies in the industrial sector in a community eco-management and audit scheme (EMAS).

4.6.4 Current Health, Safety and/or Environmental Management Standards

The current European and international occupational health and safety and/or environmental management standards are detailed in table one-two.

A comparison between the draft integrated health, safety and environmental management standard and the non-integrated European member states and international management standards was undertaken, to identify whether the integrated standard would be complete enough to use as an alternative. (There are no national integrated standards). Comparisons of the key elements of each management standard with the integrated standard are detailed in table four-sixteen.

Table 4- 16 Comparison of the Elements of OHS&E Management Standards.

	Specific Individual Management Standards								
Section/Annex headings	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**
4.01 General	✓	✓	✓	✓	✓	✓	✓	✓	✓
4.02 Policy	✓	✓	✓	✓	✓	✓	✓	✓	✓
4.2 Planning	✓	✓	✓	✓	✓			✓	
4.2.1 Assessment	✓	✓		✓					✓
4.2.2 Legal and other requirements	✓	✓		✓			✓		
4.2.3 Management arrangements (H,S & E)	✓	✓	✓	✓	✓	✓	✓	✓	✓
4.3 Implementation and operations	✓	✓	✓	✓	✓				
4.3.1 Structure and responsibility	✓	✓	✓	✓	✓		✓	✓	✓
4.3.2 Training	✓	✓	✓	✓	✓	✓			
4.3.3 Communications	✓	✓	✓	✓	✓	✓	✓		
4.3.4 Documentation	✓	✓	✓	✓	✓				✓
4.3.5 Documentary control	✓	✓	✓	✓	✓		✓	✓	
4.3.6 Operational procedures	✓	✓	✓	✓	✓		✓		
4.3.7 Emergency arrangements	✓	✓	✓	✓	✓	✓		✓	
4.4 Checking and corrective actions	✓	✓	✓	✓	✓		✓		✓
4.4.1 Monitoring & measuring	✓	✓	✓	✓			✓	✓	✓
4.4.2 Corrective actions	✓	✓	✓	✓			✓	✓	
4.4.3 Records	✓	✓	✓	✓				✓	
4.4.4 Audit	✓	✓	✓	✓					✓
4.5 Management	✓	✓	✓	✓					
A.1 Initial Status Review	✓	✓	✓	✓		✓			
B.1 Policy	✓				✓	✓			
B.2 Responsibilities	✓								
B.3 Training	✓				✓				
B.4 Communications	✓				✓				

	Specific Individual Management Standards (cont.)								
Section/Annex headings	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**
B.5 Documentation	✓					✓			
B.16 Specialist advice	✓				✓				
C.1 Risk assessment	✓				✓				
D.1 Emergency procedures	✓								
E.1 Measurement and evaluation	✓	✓			✓				
E.2 Management review	✓								
E.3 Audit	✓	✓			✓				
Integration with other standards	✓	✓		✓				✓	✓

Key

1	Author:	Draft integrated health, safety and environmental standard
2	International:	ISO 14000 series Environmental management standard
3	Europe:	Eco-Management and Audit scheme (EMAS)
4	UK:	OHSAS 18001 Occupational health and safety management standard
5	Ireland:	Draft standard for the code of practice for an occupational health and safety management standard
6	Netherlands:	Dutch Technical report: Guide to an occupational health and safety management standard
7	Germany:	Occupational health and safety management standard
8	Norway:	Management principles for enhancing quality of products and services, occupational health and safety and the environment
9	Spain:	Prevention of occupational risk: General rules for implementation of an occupational health and safety management system
✓	Included within this standard at least the majority requirements of the integrated standard.	

4.6.5 Analysis

Analysis of null hypothesis

The aim was to test the hypothesis $H0_{(2)}$ that the proposed health, safety and environmental management standard meets all relevant health, safety and environmental national and European legal requirements. The results were calculated, at the 10% level based upon a 't' data sample of n = 33 for the data sets.

The results of the calculations are detailed in table four-seventeen. This indicated that there is significant evidence that the proposed health, safety and environmental management standard meets the acceptance criteria of all relevant health, safety and environmental national and European legal requirements and that hypothesis $H0_{(1)}$ is valid.

Table 4- 17 Calculation of the Reject Criteria for Null Hypothesis H0 (2)

Number of criteria achieved (max 9)	$\frac{X - \mu}{\sigma}$	Reject criteria of <10%	Reject Yes/No
9	0.51	1.310	No
9	0.51	1.310	No
6	0.14	1.310	No
4	0.09	1.310	No
4	0.09	1.310	No
9	0.51	1.310	No
5	0.02	1.310	No
8	0.39	1.310	No
6	0.14	1.310	No
6	0.14	1.310	No
7	0.27	1.310	No
6	0.14	1.310	No
7	0.27	1.310	No
7	0.27	1.310	No
8	0.39	1.310	No
6	0.14	1.310	No
6	0.14	1.310	No
4	0.09	1.310	No
5	0.02	1.310	No
6	0.14	1.310	No
6	0.14	1.310	No
1	0.46	1.310	No
1	0.46	1.310	No
1	0.46	1.310	No
1	0.46	1.310	No
3	0.22	1.310	No
2	0.34	1.310	No
2	0.34	1.310	No
1	0.46	1.310	No
3	0.22	1.310	No
4	0.09	1.310	No
4	0.09	1.310	No

Discussion

The draft integrated management standard comprehensively covers all of the key elements contained within the non-integrated Member State standards.

The integrated standard, particularly with the annexes of significance review, risk assessment and audit, goes beyond most individual Member State standards and contains further detail with regard to how these issues can be implemented.

The International Labour Organisation reviewed both the European and world-wide standards, using the 27 measurable variables. They concluded that the Spanish standard provided the most comprehensive audit arrangements. They also commended the British and Irish health and safety management standards as containing generally strong management issues, such as hazard control, training, evaluation, and risk/hazard assessment. However, the ILO review identified a general weakness throughout the models including management commitment, resource allocation, continual improvement, integration with other organisational systems, and management review.

The weaknesses identified by the ILO in these national standards have been addressed by the draft integrated standard. In addition it reflects all the strengths listed.

Table four-eighteen lists the draft integrated standard annexes against the detailed ILO identified weaknesses.

Table 4- 18 Weaknesses of Management Standards As Identified by the ILO Compared With the Proposed Integrated Standard

ILO identified weaknesses in national standards	**Sections in which the draft integrated standard addresses the weaknesses**
Management commitment	B.1 Policy
Resource allocation	B.2 Responsibilities
Continual improvement	E.1 Measurement and evaluation
OHSMS integration with other organisational systems	By definition with health, safety and environment and specific links to quality within the annex B2
Management review	E.2 Management review

4.6.6 Conclusions

It has been demonstrated that the integrated standard complies with both European National Standards and legal requirements, and therefore could be used within any of the Member States.

This chapter has detailed the trials, results and analysis with regard to each element of the development of the proposed integrated health, safety and environmental management standard and conclusions were drawn to each of the following research questions:

Question one:	*'What is the current position regarding management systems'*
Question two:	*'The possible benefits of management systems'*
Question three:	*'What is meant by integration?'*
Question four:	*'Whether integration is feasible'*
Question five:	*'Whether integrated management systems meet national and European legal requirements.'*

Chapter five contains the final proposed integrated health, safety and environmental management standard. Chapter six will summarise the conclusions to the above research questions.

Chapter 5: The Proposed Integrated Health, Safety and Environmental Management Standard

5.1 Introduction

Following the trials detailed in chapter four, the final proposed integrated health, safety and environmental management standard was developed. This standard and the supporting appendices are contained within this chapter. The standard was designed to:

1. Be implemented and used by non-specialist personnel; and
2. Have the 'look and feel' of other International standards, particularly ISO.

For these reasons this chapter does not follow the thesis style or numbering system, as it is intended to be a 'stand alone' document.

The audit pro-forma has been removed for convenience and can be found in appendix three.

5.2 The Proposed Integrated Health, Safety and Environmental Management Standard

Foreword

This proposed standard gives guidance on health, safety and environmental (HS&E) management systems for assisting compliance with stated HS&E policies and objectives on how HS&E should be integrated within the organisation's overall management system.

This publication contains guidance and recommendations. The guidance is intended to provide general assistance to an organisation for implementing or improving a health, safety and environmental management system. This proposed standard can either be certifiable or non-certifiable.

The adoption of the health, safety and environmental management system specified in this proposed standard does not need to be established independently of any existing management system elements. In some cases, it will be possible to comply with the requirements by adapting existing management system elements.

Compliance with this proposed standard does not of itself confer immunity from legal obligations.

Guide

Organisations do not operate in a vacuum, several parties can have a legitimate interest in an organisation's approach to health, safety and environmental proposed standards including employees; customers/clients/suppliers; the community; shareholders; contractors; insurers; and the enforcement agencies.

Good health, safety and environmental performance is no accident. Organisations should attach the same importance to achievement of high standards of HS&E management as they do to other key aspects of their business activities. This demands

the introduction of a structure which will be able to adopt a structured approach to the identification of hazards and the evaluation and control of work related risks.

There are sound economic reasons for reducing work-related accidents, ill-health and environmental loss as well as ethical and regulatory reasons. Besides reducing costs, effective HS&E management promotes business efficiency.

A comprehensive legal framework already exists for health and safety by virtue of the European Framework Directive Number 89/391/EEC. This European Directive requires organisations to manage activities in such a way as to anticipate and prevent circumstances that may result in loss.

In environmental terms EEC Directive Number 84/360/EEC requires that for certain potentially polluting processes, management control be formally established to minimise potential loss or damage. However, these controls only relate to specified processes and activities and are therefore more limited in their scope as for health and safety.

This proposed standard seeks to improve the health, safety and environmental performance of organisations by providing guidance on how the management of HS&E may be integrated with the management of other aspects of business performance, in order to:

a) Minimise risk to employees and others;
b) Improve business performance; and
c) Assist organisations to establish a responsible image within the marketplace.

This guide is intended to assist organisations to develop an approach to management of HS&E in such a way as to protect employees and others both internally and externally, who may be affected by the organisation's activities. Many of the features of effective HS&E management are indistinguishable from the sound management practices advocated by proponents of quality and business excellence. These guidelines are based

on the general principles of good management and are designed to enable the integration of HS&E management within an overall management system. Drucker's maxim, 'what gets measured, gets done,' can succinctly summarise this proposed standard which in essence sets out to establish clear levels of health, safety and environmental performance and to then measure compliance against these standards.

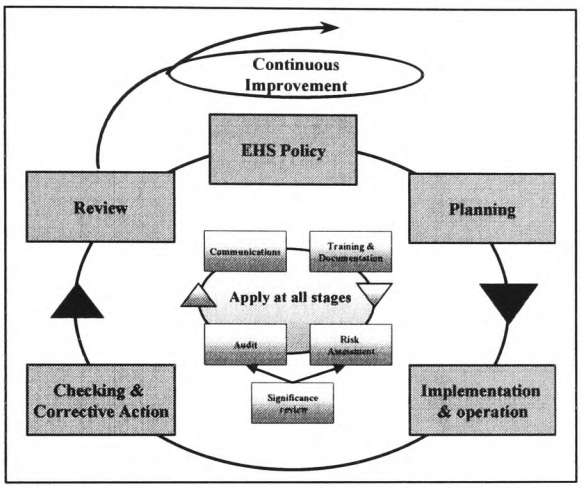


Figure 1—Health, Safety and Environmental Management System Model for this Proposed Standard

1 SCOPE

This proposed standard gives guidance on the development of health, safety and environmental (HS&E) management systems, to enable an organisation to formulate policy and objectives taking into account legislative requirements and information about significant environmental impacts. It applies to those health, safety and environmental aspects which the organisation can control and over which it can be expected to have an influence. It does not itself state specific health, safety and environmental performance criteria, nor does it seek to give detailed guidance on general management systems design. Detailed specific company and legal proposed standards will need to be identified and referenced in the initial status review.

The guide is designed for use by organisations of all sizes and regardless of the nature of their activities. It is intended that its application will be proportional to the level of risk and needs of the particular organisation.

2 NORMATIVE REFERENCES

[There are no Normative References]

3 DEFINITIONS

For the purposes of this proposed standard the following definitions apply:

3.1 accident

Unplanned event giving rise to death, ill-health (see 3.16), injury, damage or other loss.

3.2 audit

A systematic and, wherever possible, independent examination to determine whether activities and related results conform to planned arrangements and whether these arrangements are implemented effectively and are suitable to achieve the organisation's policy and objectives (see 3.23).

NOTE: The word 'independent' here does not necessarily mean external to the organisation.

3.3 audit scope

To examine or study carefully and in detail the area covered by a given activity or subject.

3.4 audit criteria

A standard, rule, or test on which a judgment or decision can be based.

3.5 continual improvement

Process of enhancing the health, safety and environmental management system to achieve improvements in overall health, safety and environmental performance in line with the organisation's health, safety and environmental policy.

3.6 consequences

The adverse effects or harm as a result of realising a hazard which cause the quality of human health or the environment to be impaired in the short or longer term.

3.7 direct environmental aspects / impacts

Those environmental aspects or impacts attributable to activities falling under the direct control of the organisation.

3.8 environment

Surroundings in which an organisation operates, including air, water, land, natural resources, flora, fauna, humans, and their interrelation.

3.9 environmental aspect

Element of an organisation's additives, products or services which can interact with the environment.

NOTE - A significant environmental aspect is an environmental aspect which has or can have a significant environmental impact.

3.10 environmental impact

Any change to the environment, whether adverse or beneficial, wholly or partially resulting from an organisation's activities, products or services.

3.11 external factors

Forces outside the control of the organisation that impinge on health and safety issues and need to be taken account of within an appropriate time frame, e.g. regulations, industry standards.

3.12 hazard

A source or a situation with a potential for harm in terms of human injury or ill-health (see 3.16), damage to property, damage to the environment, or a combination of these.

3.13 hazard identification

The process of recognising that a hazard (see 3.12) exists and defining its characteristics.

3.14 health surveillance

Monitoring the health of people to detect signs or symptoms of work related ill-health (see 3.16) where there is an identifiable cause, so that steps can be taken to eliminate, or reduce, the probability of further damage.

3.15 indirect environmental aspects / impacts

Those environmental aspects or impacts that occur as a result of the company's existence and operations but are not directly controlled by the company.

3.16 ill-health

Ill-health that is judged to have been caused by or made worse by a person's work activity or environment.

3.17 incident

Unplanned event which has the potential to lead to accident.

3.18 internal factors

Forces within the organisation that may affect its ability to deliver the health, safety and environmental policy, e.g. internal re-organisation, culture.

3.19 interested party

Individual or group concerned with or affected by the health, safety and environmental performance of an organisation.

3.20 likelihood

The probability of an event occurring (see 3.28.)

3.21 management system

A composite, at any level of complexity, of personnel, resources, policies and procedures, the components of which interact in an organised way to ensure a given task is performed, or to achieve or maintain a specified outcome.

3.22 organisation

A company, operation, firm, enterprise, institution, or association, or part thereof, whether incorporated or not, public or private, that has its own functions and administration. For organisations with more than one operating unit, a single operating unit may be defined as an organisation.

3.23 objectives

The goals, in terms of health, safety and environmental performance, that an organisation sets itself to achieve and which should be quantified wherever practicable.

3.24 performance

Measurable results of the health, safety and environmental management system, related to an organisation's control of its environmental aspects, based on its health, safety and environmental policy, objectives and targets.

3.25 policy

Statement by the organisation of its intentions and principles in relation to its overall health, safety and environmental performance which provides a framework for action and for the setting of its health, safety and environmental objectives and targets.

3.26 prevention of pollution

Use of processes, practices, materials or products that avoid, reduce or control pollution, which may include recycling, treatment, process changes, control mechanisms, efficient use of resources and material substitution.

3.27 pro-active

Active systems, which monitor the designed development installation and operation of management systems, risk controlled strategies and workplace precautions.

3.28 probability

The mathematical expression of chance (for instance 0.20 is equivalent to a 20 per cent or a one in five chance) wherever this usage is possible, but in many cases it can be no more than a prospect, which can be expressed only qualitatively. The definition applies to the occurrence of a particular event in a given period of time or as one among a number of possible events.

Applying the everyday meaning of estimation and evaluation to the defined meaning of risk leads to further terms and definitions:

3.29 reactive

Reactive systems monitor accidents, ill-health incidents, pollution events and other evidence of deficient health, safety and environmental performance.

3.30 risk

The combination of the likelihood and consequence of a specified hazardous event occurring.

3.31 risk assessment

The overall process of estimating the magnitude of risk and deciding whether or not the risk is tolerable or acceptable. Consists of risk estimation and risk evaluation. This definition of risk assessment goes beyond that in the Commission Directive 93/67/EEC, by incorporating risk evaluation.

3.32 risk estimation

The outcome or consequences of an intention taking account of the probability of occurrence.

3.33 risk evaluation

The determination of the significance of the estimated risks for those affected: it includes the element of risk perception.

3.34 risk management

The process of implementing decisions about accepting or altering risks.

3.35 risk perception

The overall view of risk held by a person or group and includes both feeling and judgment.

3.36 status review

The formal evaluation of the health, safety and environmental management system.

3.37 severity

How serious the consequences of harm may be resulting from an incident.

3.38 significant environmental aspect

Significant environmental aspects are those of most concern in terms of environmental interaction and the potential for negative environmental impact.

3.39 tolerability

Tolerability does not mean 'acceptability.' It refers to the willingness to live with a risk to secure certain benefits and in the confidence that it is being properly controlled. To tolerate a risk means that users do not regard it as negligible or something we might ignore but rather as something we need to keep under review and reduce still further if, and as, we can.

3.40 target

Detailed performance requirements, arising from the health, safety and environmental objectives that need to be set and met in order to achieve those objectives. Where practicable these should be quantified and applicable to the organisation or parts thereof.

4.0.1 General

The organisation shall establish and maintain the health, safety and environmental management system.

4.0.2 Policy

Organisations should consider carrying out an initial review of their existing arrangements for managing health, safety and environmental issues. This review should be made to provide a baseline from which progress can be measured. Initial status reviews should answer the question "where are we now?" Further details of this initial review are contained in Annex A of this proposed standard.

4.1 Health, Safety and Environmental Policy

The organisation's most senior management should define, document and endorse its health, safety and environmental policy.

4.2 Planning

The plan should identify health, safety and environmental requirements, setting clear performance criteria defining what is to be done, who is responsible, when it is to be done and the desired outcome.

4.2.1 Assessment

The organisation should carry out risk assessment including identification of health, safety and environmental hazards and identify those aspects of its activities in order to determine which have or can have significant impacts on both man and the environment. Both the risks and significant environmental effects should be clearly identified and documented.

4.2.2 Legal and other requirements

The organisation shall establish and maintain a procedure to identify and have access to legal, and other requirements such as standards codes of practice etc., directly applicable to the health, safety and environmental aspects of its activities.

4.2.3 Health, Safety and Environmental Management Arrangements

The organisation should make arrangements to cover the following key areas:

a) Overall plans and objectives;
b) Designation of responsibility for achieving objectives and targets;
c) The means and time frame by which they are to be achieved;
d) Have, or have access to, sufficient health, safety and environmental knowledge skills;
e) Planning for operational control activities;
f) Planning for performance measurement, corrective action, audits, and management reviews and implementing any corrective actions showed to be necessary.

4.3 Implementation and Operation

4.3.1 Structure and responsibility

Ultimate responsibility for health, safety and environment and environmental control rests with top management. At all levels of the organisation, people need to be:

a) Responsible for the health, safety and environment for the area they manage and of those they manage, themselves and others with whom they work;
b) Aware of their responsibility for the health, safety and environment of people who may be affected by the activities they control, e.g. contractors, members of the public etc;
c) Aware of the influence that their action or inaction can have on the effectiveness of the health, safety and environmental management system.

4.3.2 Training, Awareness and Competence

The organisation should make arrangements to identify the competencies required, at all levels within the organisation, and organise any necessary training. It shall require that all personnel whose work may create a significant impact upon the health and safety of personnel, or the environment, have received appropriate training.

4.3.3 Communications

The organisation should establish and maintain arrangements, where appropriate, for:

a) The effective and open communication of health, safety and environmental information;

b) The provision of specialist advice and services;
c) Employee involvement and consultation;
d) Internal communication between the various levels and functions of the organisation;
e) Receiving, documenting and responding to relevant communication from external interested parties.

The organisation shall consider processes for external communication on both its significant health, safety and environmental aspects and record its decision.

4.3.4 Health, Safety and Environmental Management System Documentation

Documentation is an important element in enabling an organisation to implement a successful health, safety and environmental management system. It is also important in assembling and retaining health, safety and environmental knowledge. However, it is important that documentation is kept to the minimum required for effectiveness and efficiency.

4.3.5 Document control

Organisations should make arrangements to ensure that documents are up to date and applicable to the purpose for which they are intended.

4.3.6 Operational control

It is important that health, safety and environmental issues, in their broadest sense, are fully integrated across the organisation and into all its activities, whatever the size or nature of its work. In organising for the implementation of the policy and the effective management of health, safety and environmental standards, the organisation should make arrangements to ensure that activities are carried out safely and in a responsible manner in accordance with arrangements defined in 4.2.3 and should:

a) Define the allocation of responsibilities and accountabilities in the management structure;
b) Ensure people have the necessary authority to carry out their responsibilities;
c) Allocate adequate resources commensurate with its size and nature;
d) Establish and maintain documented procedures to cover situations where their absence could lead to deviations from the policy, objectives and targets;
e) Stipulate operating criteria in the procedures;
f) Establish and maintain procedures related to the identifiable significant environmental aspects of goods and services used by the organisation;

g) Communicate relevant procedures and requirements to suppliers and contractors.

4.3.7 Emergency Preparedness and Response

The organisation shall establish and maintain procedures to identify potential for and respond to accidents and emergency situations, and for preventing and mitigating the health, safety and environmental impacts that may be associated with them.

The organisation shall review and revise, where necessary, its emergency preparedness and response procedures, in particular, after the occurrence of accidents or emergency situations.

The organisation shall also periodically test such procedures where practicable.

4.4 Checking and Corrective Action

4.4.1 Monitoring and Measurement

The organisation shall establish and maintain documented procedures to monitor and measure on a regular basis the key characteristics of its operations and activities that can have a significant impact on either the health and safety of people or upon the environment. This shall include the recording of information to track performance, relevant operational controls and conformance with the organisation's objectives and targets.

The organisation shall establish and maintain a documented procedure for periodically evaluating compliance with relevant health, safety and environmental legislation and regulations.

4.4.2 Corrective Action

Where deficiencies are found, root causes should be identified and corrective action taken. Such action taken to eliminate the causes of actual and potential non-conformance shall be appropriate to the magnitude of problems and commensurate with the health, safety and environmental impact encountered.
The organisation shall implement and record any changes in the documented procedures resulting from corrective and preventive action.

4.4.3 Records

The organisation shall establish and maintain procedures for the identification. maintenance and disposition of health, safety and environmental records. These records shall include any records necessary to demonstrate compliance with legal requirements, training records and the results of audits and reviews.

Records shall be legible, identifiable and traceable to the activity, product or service involved. Records shall be stored and maintained in such a way that they are readily retrievable and protected against damage, deterioration or loss. Their retention times shall be established and recorded.

4.4.4 Audit

In addition to routine monitoring of health, safety and environment performance, there will be a need for periodic externally verified third party audits (not necessarily certified) that enable a deeper and more critical appraisal of all the elements of the health, safety and environmental management system.

a) The organisation shall establish and maintain a programme(s) and procedures for periodic management system audits to be carried out, in order to determine whether or not the health, safety and environmental management system:

    1) Conforms to planned arrangements for health, safety and environmental management including the requirements of this standard;
    2) Has been property implemented and maintained.

The audit programme, including any schedule, shall be based on the relative importance of the activity concerned and the results of previous audits. In order to be comprehensive, the audit procedures shall cover the audit scope, frequency and methodologies, as well as the responsibilities and requirements for conducting audits and reporting results.

4.5 Management Review

The organisation should define the frequency and scope of periodic reviews of the health, safety and environmental management system according to its needs. These reviews should consider:

a) The overall performance of the health, safety and environmental management system;
b) The performance of individual elements of the system;
c) The findings of audits;
d) Internal and external factors, such as changes in organisational structure, legislation pending, the introduction of new technology, etc.

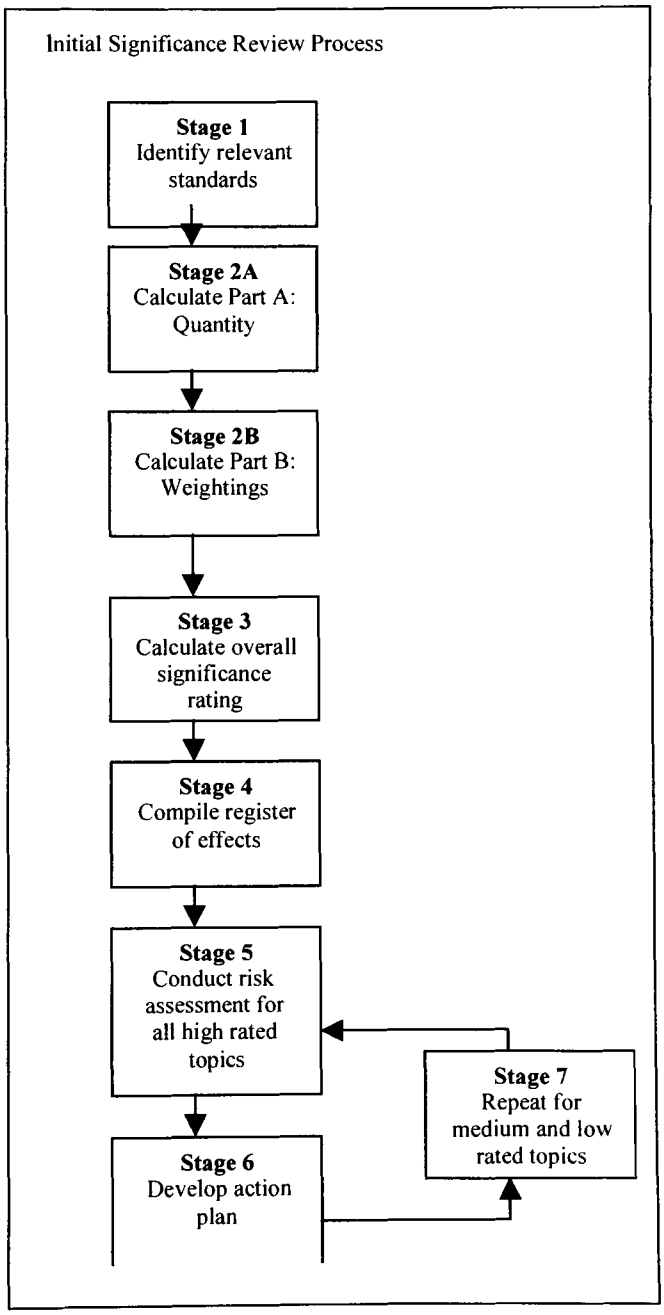
and identify what action is necessary to remedy any deficiencies.

The health, safety and environment management system should be designed to accommodate or adapt to internal and external factors. The management review also provides an opportunity to take a forward look. The information in (a) to (d) above can be used by the organisation to improve the organisation's proactive approach to minimising risk, and improve business performance.

Annex A (informative)

A.1 Initial Significance Review

The purpose of the review is to broadly determine the current levels on occupational health, safety and environmental performance of the company against agreed, usually legal, minimum standards. This will enable the introduction of this management standard to be focused on reducing potential loss and to maximise the organisation's effectiveness. The purpose of the initial review is **not to undertake risk assessments**, but to prioritise the risk assessment process, and examine quickly those significant items that could lead to harm or loss.



Often when an organisation conducts the risk assessment process, the programme may take a considerable time to complete. There is a danger that if this programme is not prioritised then health, safety or environmental topics of significance non-performance may not be assessed until later in the risk assessment programme and lead to significant harm or loss. By conducting an initial review, which will prioritise the risk assessment process, this should prevent uncontrolled losses

occurring as described above. The initial review process is broken down into a number of discrete stages namely:

Stage 1

An initial assessment of the processes should be undertaken to determine a list of relevant standards including legal standards, industry codes of practice and company standards. These standards will be used in stage two.

Stage 2 (A and B)

The plant is reviewed against the criteria contained in this annex and a significance category of either high, medium or low assigned. The criteria will assess the following numerical factors for each health, safety and environmental topic:

- **Part A:** **Quantity; and**
- **Part B :** **Significance Factors which comprises of:**
  - Severity of Outcome (S);
  - Degree of Control (C);
  - Business Risk (BR).

The criteria contained in this annex considers seventeen of the common health, safety and environmental topics. Where there are complex and unusual plant or processes, it will be necessary to make a note of these during stage one to ensure that the topics are not overlooked in this review, which may be constrained by the list of the seventeen significance topics which have been developed and detailed later in this section.

Stage 3

From the total numerical score calculated for each topic, one of three ratings are assigned, namely:

High Significance:

Is the highest level of priority in terms of actual or potential impact. A detailed risk assessment should be carried out forthwith and the outcomes of this further detailed assessment are the priority areas for address by the operational and improvement elements of the HS&EMS.

Medium Significance:

Areas are recognised as causing some impact. Aspects classified as being of "medium significance" will not be addressed in the current round of risk assessments. It is however, recognised that these aspects may become actionable items and should be monitored and on completion of the "high" significance topics, these will be further assessed.

Low Significance:

Areas are those aspects identified as being either irrelevant in a particular area or being of extremely low incidence or impact. It is not envisaged that the risk assessment will address these issues in the current improvement planning.

The outcomes of Stage 3 can then be used to:

- Conduct detailed risk assessments on 'high significant' processes identified. Please see Annex C for details as to methodology of risk assessment.
- Develop an immediate remedial action plan.

N.B. It may be necessary for this initial status review to be conducted by an external body with sufficient knowledge to determine both:

- What may be significant other than those topics listed; and
- What standards are applicable.

Stage 4

On completion of this initial review, a list of relevant standards including legal standards, industry codes of practice and company standards should be compiled for the 'significant' processes identified.

The results of the significance assessments of both direct and indirect health, safety and environmental aspects will be recorded in a control document. Details relating to the "high significance" areas are recorded in the register entries. Supporting notes relating to "medium" and "low" areas are recorded in the Effects Evaluation file.

Stage 5

A detailed risk assessment of all topics rated as "High" should be undertaken. A methodology for risk assessment is contained in annex C.

Stage 6

Only on completion of the risk assessment exercise for the high significance items can any remedial action plan be put in place. The action plan itself whenever possible should be:

- Specific;
- Measurable;
- Achievable;
- Relevant;
- Timed

The list of key objectives should be prioritised. Priority should be given to objectives relating to specific legal requirements. Consideration should also be given to objectives that in themselves are not high-risk but nevertheless can be achieved relatively easily and cheaply.

Stage 7

On completion of the "high" significance items, then an iterative loop of risk assessments of the "medium" then "low" significance topics is undertaken and remedial action plans developed.

A 2.0 PART A SIGNIFICANCE ASSESSMENT PROCEDURES

The emphasis of this methodology is that it is "topic" focused. It is intended that this will allow an overall assessment of the principal health, safety and environmental issue areas. The topics assessed are:

Environment		Safety		Health	
A2.9	Solid waste generation	A2.4	Machinery safety	A.2.1	Manual handling
A2.10	Atmospheric emissions	A2.5	Electrical safety	A2.2	Substances hazardous to health
A2.11	Water usage	A2.6	Transport	A2.3	Noise
A2.12	Effluent	A2.7	Housekeeping	A2.17	Hand arm vibration
A2.13	Raw materials usage	A2.8	Fire		
A2.14	Energy usage	A2.16	Use of contractors		
A2.15	Environmental noise				

For each topic the proforma assessment form should be completed.

Part A: Quantity is intended to account for the amount, volume or usage of the topic. The greater the usage the more significant this topic will be. This volume factor will be used in the calculation of the overall significance factor.

Part B: Significance Factor is intended to account for three sub factors:

1 Severity of Outcome (S)

The seriousness of the outcome to individual health and safety and to the environment including fauna and flora, if the controls are not sufficient or fail.

2 Degree of Control (C)

How effective, in comparison to minimum legal standards, are the controls to minimise the risk?

3 Business Risk (BR)

What would be the impact to the business if an incident were to occur?

Each sub-factor is assigned a numerical value which are then multiplied together to provide a total score for part B significance factor.

Overall significance rating is calculated by adding Part A volume and Part B significance factor together and then converting the numerical score into one of three significance factors.

The total significance factor ratings for each topic are entered into Form B.

A2.1 Manual Handling

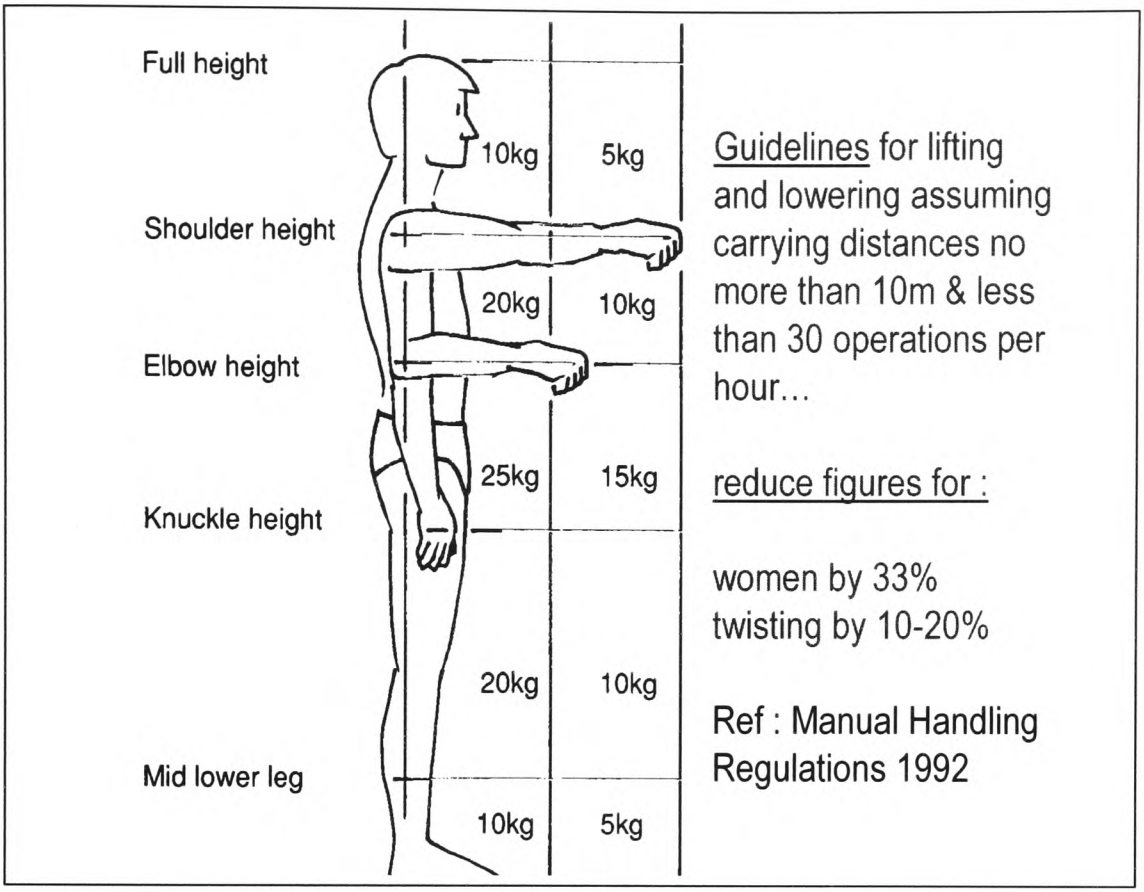
Part A Volume		**Score**
Limited lifting operations Numerous lifting tasks of "light" loads below chart values		1
Tasks involve lifting above chart values Many frequent activities involve lifting above chart values		2

Part B Significance Factor					
Severity of Outcome (S)		***Degree of Control (C)***		***Business Risk (BR)***	
Minor injury, short term ill health, minor environmental impact	**1**	Best practice standards with full management and documentation	**1**	Limited impact if worst case scenario	**1**
Major injury ill health causing loss of at least 1 week, damage to species such as fish poisoning	**2**	Meeting legal compliance with full management and documentation	**2**	Limited effects, no production loss, limited local publicity	**2**
Death/permanent ill-health or significant species damage	**3**	Meeting legal compliance with limited documentation or systems	**3**	Short term production loss (loss of weeks) Enforcement Notice	**3**
		Below legal compliance	**4**	Death, damage to production and/or major environmental impact causing adverse publicity and fine	**4**
				Multiple deaths, significant damage to production causing possible permanent loss and/or major environmental impact causing significant adverse publicity	**5**
Severity of Outcome (S)		**Degree of Control (C)**		**Business Risk (BR)**	
Part B Significance Factor = (S) × (C) × (BR) =					

Part C Score = Part A Volume + Part B Significance Factor

	Part A Score	**Part B Score**
Total		

	1-40	**41-80**	**81-160**
Overall Significance Factor	**Low**	**Medium**	**High**


Full height
Shoulder height
Elbow height
Knuckle height
Mid lower leg
10kg
5kg
20kg
10kg
25kg
15kg
20kg
10kg
10kg
5kg
Guidelines for lifting and lowering assuming carrying distances no more than 10m & less than 30 operations per hour...
reduce figures for :
women by 33%
twisting by 10-20%
Ref : Manual Handling Regulations 1992

A2.2 Substances Hazardous to Health

Part A Volume		**Score**
Low use of substances		1
Factory processes Use of substances with MEL		2

Part B Significance Factor					
Severity of Outcome (S)		***Degree of Control (C)***		***Business Risk (BR)***	
Minor injury, short term ill health, minor environmental impact	**1**	Best practice standards with full management and documentation	**1**	Limited impact if worst case scenario	**1**
Major injury ill health causing loss of at least 1 week, damage to species such as fish poisoning	**2**	Meeting legal compliance with full management and documentation	**2**	Limited effects, no production loss, limited local publicity	**2**
Death/permanent ill-health or significant species damage	**3**	Meeting legal compliance with limited documentation or systems	**3**	Short term production loss (loss of weeks) Enforcement Notice	**3**
		Below legal compliance	**4**	Death, damage to production and/or major environmental impact causing adverse publicity and fine	**4**
				Multiple deaths, significant damage to production causing possible permanent loss and/or major environmental impact causing significant adverse publicity	**5**
Severity of Outcome (S)		**Degree of Control (C)**		**Business Risk (BR)**	
Part B Significance Factor = (S) × (C) × (BR) =					

Part C Score = Part A Volume + Part B Significance Factor			
	Part A Score	**Part B Score**	
Total			
	1-40	**41-80**	**81-160**
Significance Factor	**Low**	**Medium**	**High**

A2.3 Noise

Part A Volume		**Score**
Levels always below 85 dB(A)		1
Occasional exposure for short periods above 85 dB(A)		
Exposure above 85 dB(A) for 8hours		2
Exposure above 90dB(A)		

Part B Significance Factor

Severity of Outcome (S)		***Degree of Control (C)***		***Business Risk (BR)***	
Minor injury, short term ill health, minor environmental impact	**1**	Best practice standards with full management and documentation	**1**	Limited impact if worst case scenario	**1**
Major injury ill health causing loss of at least 1 week, damage to species such as fish poisoning	**2**	Meeting legal compliance with full management and documentation	**2**	Limited effects, no production loss, limited local publicity	**2**
Death/permanent ill-health or significant species damage	**3**	Meeting legal compliance with limited documentation or systems	**3**	Short term production loss (loss of weeks) Enforcement Notice	**3**
		Below legal compliance	**4**	Death, damage to production and/or major environmental impact causing adverse publicity and fine	**4**
				Multiple deaths, significant damage to production causing possible permanent loss and/or major environmental impact causing significant adverse publicity	**5**
Severity of Outcome (S)		**Degree of Control (C)**		**Business Risk (BR)**	

Part B Significance Factor = (S) × (C) × (BR) =

Part C Score = Part A Volume + Part B Significance Factor

	Part A Score	**Part B Score**
Total		

	1-40	**41-80**	**81-160**
Significance Factor	**Low**	**Medium**	**High**

A2.4 Machinery Safety

Part A Volume		**Score**
Limited mechanised processes		1
Mechanised processes requiring little operator access e.g. small printing press		
Significant mechanised processes requiring little operator access e.g. robot cell		2
Significant mechanised processes requiring regular operator access e.g. power press		

Part B Significance Factor					
Severity of Outcome (S)		***Degree of Control (C)***		***Business Risk (BR)***	
Minor injury, short term ill health, minor environmental impact	**1**	Best practice standards with full management and documentation	**1**	Limited impact if worst case scenario	**1**
Major injury ill health causing loss of at least 1 week, damage to species such as fish poisoning	**2**	Meeting legal compliance with full management and documentation.	**2**	Limited effects, no production loss, limited local publicity	**2**
Death/permanent ill-health or significant species damage	**3**	Meeting legal compliance with limited documentation or systems	**3**	Short term production loss (loss of weeks) Enforcement Notice	**3**
		Below legal compliance	**4**	Death, damage to production and/or major environmental impact causing adverse publicity and fine	**4**
				Multiple deaths, significant damage to production causing possible permanent loss and/or major environmental impact causing significant adverse publicity	**5**
Severity of Outcome (S)		**Degree of Control (C)**		**Business Risk (BR)**	
Part B Significance Factor = (S) × (C) × (BR) =					

Part C Score = Part A Volume + Part B Significance Factor			
	Part A Score	**Part B Score**	
Total			
	1-40	**41-80**	**81-160**
Significance Factor	**Low**	**Medium**	**High**

A2.5 Electrical safety

Part A Volume		**Score**
Office type environment using max 240v		1
Factory environment using 415 volt, 3 phase supply		
Use of 240v portable equipment		2
"Live" electrical testing		

Part B Significance Factor

Severity of Outcome (S)		***Degree of Control (C)***		***Business Risk (BR)***	
Minor injury, short term ill health, minor environmental impact	**1**	Best practice standards with full management and documentation	**1**	Limited impact if worst case scenario	**1**
Major injury ill health causing loss of at least 1 week, damage to species such as fish poisoning	**2**	Meeting legal compliance with full management and documentation	**2**	Limited effects, no production loss, limited local publicity	**2**
Death/permanent ill-health or significant species damage	**3**	Meeting legal compliance with limited documentation or systems	**3**	Short term production loss (loss of weeks) Enforcement Notice	**3**
		Below legal compliance	**4**	Death, damage to production and/or major environmental impact causing adverse publicity and fine	**4**
				Multiple deaths, significant damage to production causing possible permanent loss and/or major environmental impact causing significant adverse publicity	**5**
Severity of Outcome (S)		**Degree of Control (C)**		**Business Risk (BR)**	

Part B Significance Factor = (S) × (C) × (BR) =	

Part C Score = Part A Volume + Part B Significance Factor

	Part A Score	**Part B Score**
Total		

	1-40	**41-80**	**81-160**
Significance Factor	**Low**	**Medium**	**High**

A2.6 Internal Transport

Part A Volume		**Score**
No internal transport		1
Use of non-powered internal transport		
Use of powered internal transport		2

Part B Significance Factor					
Severity of Outcome (S)		***Degree of Control (C)***		***Business Risk (BR)***	
Minor injury, short term ill health, minor environmental impact	**1**	Best practice standards with full management and documentation	**1**	Limited impact if worst case scenario	**1**
Major injury ill health causing loss of at least 1 week, damage to species such as fish poisoning	**2**	Meeting legal compliance with full management and documentation	**2**	Limited effects, no production loss, limited local publicity	**2**
Death/permanent ill-health or significant species damage	**3**	Meeting legal compliance with limited documentation or systems	**3**	Short term production loss (loss of weeks) Enforcement Notice	**3**
		Below legal compliance	**4**	Death, damage to production and/or major environmental impact causing adverse publicity and fine	**4**
				Multiple deaths, significant damage to production causing possible permanent loss and/or major environmental impact causing significant adverse publicity	**5**
Severity of Outcome (S)		**Degree of Control (C)**		**Business Risk (BR)**	
Part B Significance Factor = (S) × (C) × (BR) =					

Part C Score = Part A Volume + Part B Significance Factor			
	Part A Score	**Part B Score**	
Total			
	1-40	**41-80**	**81-160**
Significance Factor	**Low**	**Medium**	**High**

A2.7 Housekeeping

Part A Volume		**Score**
Any Premises		1
Premises in an industrial setting		
Premises in a residential setting		2
Premises in a SSI setting		

Part B Significance Factor					
Severity of Outcome (S)		***Degree of Control (C)***		***Business Risk (BR)***	
Minor injury, short term ill health, minor environmental impact	**1**	Best practice standards with full management and documentation	**1**	Limited impact if worst case scenario	**1**
Major injury ill health causing loss of at least 1 week, damage to species such as fish poisoning	**2**	Meeting legal compliance with full management and documentation	**2**	Limited effects, no production loss, limited local publicity	**2**
Death/permanent ill-health or significant species damage	**3**	Meeting legal compliance with limited documentation or systems	**3**	Short term production loss (loss of weeks) Enforcement Notice	**3**
		Below legal compliance	**4**	Death, damage to production and/or major environmental impact causing adverse publicity and fine	**4**
				Multiple deaths, significant damage to production causing possible permanent loss and/or major environmental impact causing significant adverse publicity	**5**
Severity of Outcome (S)		**Degree of Control (C)**		**Business Risk (BR)**	
Part B Significance Factor = (S) × (C) × (BR) =					

Part C Score = Part A Volume + Part B Significance Factor			
	Part A Score	**Part B Score**	
Total			
	1-40	**41-80**	**81-160**
Significance Factor	**Low**	**Medium**	**High**

A2.8 Fire

Part A Volume		**Score**
Few people employed on ground floor only Multi story building		1
Factory process Process involving the use of HFL's		2

Part B Significance Factor

Severity of Outcome (S)		***Degree of Control (C)***		***Business Risk (BR)***	
Minor injury, short term ill health, minor environmental impact	**1**	Best practice standards with full management and documentation	**1**	Limited impact if worst case scenario	**1**
Major injury ill health causing loss of at least 1 week, damage to species such as fish poisoning	**2**	Meeting legal compliance with full management and documentation	**2**	Limited effects, no production loss, limited local publicity	**2**
Death/permanent ill-health or significant species damage	**3**	Meeting legal compliance with limited documentation or systems	**3**	Short term production loss (loss of weeks) Enforcement Notice	**3**
		Below legal compliance	**4**	Death, damage to production and/or major environmental impact causing adverse publicity and fine	**4**
				Multiple deaths, significant damage to production causing possible permanent loss and/or major environmental impact causing significant adverse publicity	**5**
Severity of Outcome (S)		**Degree of Control (C)**		**Business Risk (BR)**	

Part B Significance Factor = (S) × (C) × (BR) =	

Part C Score = Part A Volume + Part B Significance Factor

	Part A Score	**Part B Score**
Total		

	1-40	**41-80**	**81-160**
Significance Factor	**Low**	**Medium**	**High**

A2.9 Solid Waste Generation

Part A Volume		**Score**
No significant waste generation (less than one 50 litre wheelie bin per week)		1
Small quantities of special / hazardous waste produced (less than one 50 litre wheelie bin per week)		
Some waste recycling / reuse but less than 50%		2
Regular significant quantities of special / hazardous waste produced		

Part B Significance Factor					
Severity of Outcome (S)		***Degree of Control (C)***		***Business Risk (BR)***	
Minor injury, short term ill health, minor environmental impact	**1**	Best practice standards with full management and documentation	**1**	Limited impact if worst case scenario	**1**
Major injury ill health causing loss of at least 1 week, damage to species such as fish poisoning	**2**	Meeting legal compliance with full management and documentation	**2**	Limited effects, no production loss, limited local publicity	**2**
Death/permanent ill-health or significant species damage	**3**	Meeting legal compliance with limited documentation or systems	**3**	Short term production loss (loss of weeks) Enforcement Notice	**3**
		Below legal compliance	**4**	Death, damage to production and/or major environmental impact causing adverse publicity and fine	**4**
				Multiple deaths, significant damage to production causing possible permanent loss and/or major environmental impact causing significant adverse publicity	**5**
Severity of Outcome (S)		**Degree of Control (C)**		**Business Risk (BR)**	
Part B Significance Factor = (S) × (C) × (BR) =					

Part C Score = Part A Volume + Part B Significance Factor			
	Part A Score	**Part B Score**	
Total			
	1-40	**41-80**	**81-160**
Significance Factor	**Low**	**Medium**	**High**

A2.10 Atmospheric Emissions (including dust and odour)

Part A Volume		**Score**
No direct atmospheric emissions possible		1
Irregular / periodic non - LAAPC emissions Non LAAPC emissions but constant / frequent & predictable		2

Part B Significance Factor

Severity of Outcome (S)		***Degree of Control (C)***		***Business Risk (BR)***	
Minor injury, short term ill health, minor environmental impact	**1**	Best practice standards with full management and documentation	**1**	Limited impact if worst case scenario	**1**
Major injury ill health causing loss of at least 1 week, damage to species such as fish poisoning	**2**	Meeting legal compliance with full management and documentation	**2**	Limited effects, no production loss, limited local publicity	**2**
Death/permanent ill-health or significant species damage	**3**	Meeting legal compliance with limited documentation or systems	**3**	Short term production loss (loss of weeks) Enforcement Notice	**3**
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				Multiple deaths, significant damage to production causing possible permanent loss and/or major environmental impact causing significant adverse publicity	**5**
Severity of Outcome (S)		**Degree of Control (C)**		**Business Risk (BR)**	

Part B Significance Factor = (S) × (C) × (BR) =	

Part C Score = Part A Volume + Part B Significance Factor

	Part A Score	**Part B Score**
Total		

	1-40	**41-80**	**81-160**
Significance Factor	**Low**	**Medium**	**High**

A2.11 Water Usage

Part A Volume		**Score**
"Domestic" type water use Process usage - periodic and/or small quantities		1
Non-process use but significant use for washing down Process usage - frequent / continuous		2

Part B Significance Factor

Severity of Outcome (S)		***Degree of Control (C)***		***Business Risk (BR)***	
Minor injury, short term ill health, minor environmental impact	**1**	Best practice standards with full management and documentation	**1**	Limited impact if worst case scenario	**1**
Major injury ill health causing loss of at least 1 week, damage to species such as fish poisoning	**2**	Meeting legal compliance with full management and documentation	**2**	Limited effects, no production loss, limited local publicity	**2**
Death/permanent ill-health or significant species damage	**3**	Meeting legal compliance with limited documentation or systems	**3**	Short term production loss (loss of weeks) Enforcement Notice	**3**
		Below legal compliance	**4**	Death, damage to production and/or major environmental impact causing adverse publicity and fine	**4**
				Multiple deaths, significant damage to production causing possible permanent loss and/or major environmental impact causing significant adverse publicity	**5**
Severity of Outcome (S)		**Degree of Control (C)**		**Business Risk (BR)**	
Part B Significance Factor = (S) × (C) × (BR) =					

Part C Score = Part A Volume + Part B Significance Factor

	Part A Score	**Part B Score**
Total		

	1-40	**41-80**	**81-160**
Significance Factor	**Low**	**Medium**	**High**

A2.12 Effluent Production

Part A Volume		**Score**
Low volume / low contamination effluent production		1
High volume / low contamination effluent production		
Low volume / high contamination effluent production		2
High volume / high contamination effluent production		

Part B Significance Factor					
Severity of Outcome (S)		***Degree of Control (C)***		***Business Risk (BR)***	
Minor injury, short term ill health, minor environmental impact	**1**	Best practice standards with full management and documentation	**1**	Limited impact if worst case scenario	**1**
Major injury ill health causing loss of at least 1 week, damage to species such as fish poisoning	**2**	Meeting legal compliance with full management and documentation	**2**	Limited effects, no production loss, limited local publicity	**2**
Death/permanent ill-health or significant species damage	**3**	Meeting legal compliance with limited documentation or systems	**3**	Short term production loss (loss of weeks) Enforcement Notice	**3**
		Below legal compliance	**4**	Death, damage to production and/or major environmental impact causing adverse publicity and fine	**4**
				Multiple deaths, significant damage to production causing possible permanent loss and/or major environmental impact causing significant adverse publicity	**5**
Severity of Outcome (S)		**Degree of Control (C)**		**Business Risk (BR)**	
Part B Significance Factor = (S) × (C) × (BR) =					

Part C Score = Part A Volume + Part B Significance Factor

	Part A Score	**Part B Score**
Total		

	1-40	**41-80**	**81-160**
Significance Factor	**Low**	**Medium**	**High**

A2.13 Raw Materials Usage

Part A Volume		**Score**
Used in small quantities (e.g. periodic support usage)		1
Used in medium quantities (e.g. frequent/continuous support usage)		
Use of non-renewable and non-recyclable resources (e.g. mixed plastic)		2
Used in large quantities (e.g. product / process usage)		

Part B Significance Factor					
Severity of Outcome (S)		***Degree of Control (C)***		***Business Risk (BR)***	
Minor injury, short term ill health, minor environmental impact	**1**	Best practice standards with full management and documentation	**1**	Limited impact if worst case scenario	**1**
Major injury ill health causing loss of at least 1 week, damage to species such as fish poisoning	**2**	Meeting legal compliance with full management and documentation	**2**	Limited effects, no production loss, limited local publicity	**2**
Death/permanent ill-health or significant species damage	**3**	Meeting legal compliance with limited documentation or systems	**3**	Short term production loss (loss of weeks) Enforcement Notice	**3**
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				Multiple deaths, significant damage to production causing possible permanent loss and/or major environmental impact causing significant adverse publicity	**5**
Severity of Outcome (S)		**Degree of Control (C)**		**Business Risk (BR)**	
Part B Significance Factor = (S) × (C) × (BR) =					

Part C Score = Part A Volume + Part B Significance Factor			
	Part A Score	**Part B Score**	
Total			
	1-40	**41-80**	**81-160**
Significance Factor	**Low**	**Medium**	**High**

A2.14 Energy Usage

Part A Volume (either)			Score
Electricity Lighting	**Gas** No usage		1
Non-continuous machinery use Continuous machinery use (including transport)	Minor user (heating only) Major user (heating and process usage)		2

Part B Significance Factor					
Severity of Outcome (S)		***Degree of Control (C)***		***Business Risk (BR)***	
Minor injury, short term ill health, minor environmental impact	**1**	Best practice standards with full management and documentation	**1**	Limited impact if worst case scenario	**1**
Major injury ill health causing loss of at least 1 week, damage to species such as fish poisoning	**2**	Meeting legal compliance with full management and documentation	**2**	Limited effects, no production loss, limited local publicity	**2**
Death/permanent ill-health or significant species damage	**3**	Meeting legal compliance with limited documentation or systems	**3**	Short term production loss (loss of weeks) Enforcement Notice	**3**
		Below legal compliance	**4**	Death, damage to production and/or major environmental impact causing adverse publicity and fine	**4**
				Multiple deaths, significant damage to production causing possible permanent loss and/or major environmental impact causing significant adverse publicity	**5**
Severity of Outcome (S)		**Degree of Control (C)**		**Business Risk (BR)**	
Part B Significance Factor = (S) × (C) × (BR) =					

Part C Score = Part A Volume + Part B Significance Factor			
	Part A Score	**Part B Score**	
Total			
	1-40	**41-80**	**81-160**
Significance Factor	**Low**	**Medium**	**High**

A2.15 Environmental Noise

Part A Volume		Score
Not audible outside building		1
Audible outside building		2
History of complaints		

Part B Significance Factor

Severity of Outcome (S)		*Degree of Control (C)*		*Business Risk (BR)*	
Minor injury, short term ill health, minor environmental impact	1	Best practice standards with full management and documentation	1	Limited impact if worst case scenario	1
Major injury ill health causing loss of at least 1 week, damage to species such as fish poisoning	2	Meeting legal compliance with full management and documentation	2	Limited effects, no production loss, limited local publicity	2
Death/permanent ill-health or significant species damage	3	Meeting legal compliance with limited documentation or systems	3	Short term production loss (loss of weeks) Enforcement Notice	3
		Below legal compliance	4	Death, damage to production and/or major environmental impact causing adverse publicity and fine	4
				Multiple deaths, significant damage to production causing possible permanent loss and/or major environmental impact causing significant adverse publicity	5
Severity of Outcome (S)		**Degree of Control (C)**		**Business Risk (BR)**	

Part B Significance Factor = (S) × (C) × (BR) =	

Part C Score = Part A Volume + Part B Significance Factor

	Part A Score	**Part B Score**
Total		

	1-40	**41-80**	**81-160**
Significance Factor	**Low**	**Medium**	**High**

A2.16 Control of Contractors

Part A Volume		**Score**
No contractors used		1
Occasional use of contractors		
Extensive use of contractors		2

Part B Significance Factor					
Severity of Outcome (S)		***Degree of Control (C)***		***Business Risk (BR)***	
Minor injury, short term ill health, minor environmental impact	**1**	Best practice standards with full management and documentation	**1**	Limited impact if worst case scenario	**1**
Major injury ill health causing loss of at least 1 week, damage to species such as fish poisoning	**2**	Meeting legal compliance with full management and documentation	**2**	Limited effects, no production loss, limited local publicity	**2**
Death/permanent ill-health or significant species damage	**3**	Meeting legal compliance with limited documentation or systems	**3**	Short term production loss (loss of weeks) Enforcement Notice	**3**
		Below legal compliance	**4**	Death, damage to production and/or major environmental impact causing adverse publicity and fine	**4**
				Multiple deaths, significant damage to production causing possible permanent loss and/or major environmental impact causing significant adverse publicity	**5**
Severity of Outcome (S)		**Degree of Control (C)**		**Business Risk (BR)**	
Part B Significance Factor = (S) × (C) × (BR) =					

Part C Score = Part A Volume + Part B Significance Factor			
	Part A Score	**Part B Score**	
Total			
	1-40	**41-80**	**81-160**
Significance Factor	**Low**	**Medium**	**High**

A2.17: Exposure to Vibration

Part A Volume		Score
Little tasks involving exposure to vibration		1
Some (less than 2 hours per day) tasks involving exposure to vibration		
Frequent (more than 2 hours per day) tasks involving exposure to vibration		2

Part B Significance Factor					
Severity of Outcome (S)		*Degree of Control (C)*		*Business Risk (BR)*	
Minor injury, short term ill health, minor environmental impact	1	Best practice standards with full management and documentation	1	Limited impact if worst case scenario	1
Major injury ill health causing loss of at least 1 week, damage to species such as fish poisoning	2	Meeting legal compliance with full management and documentation	2	Limited effects, no production loss, limited local publicity	2
Death/permanent ill-health or significant species damage	3	Meeting legal compliance with limited documentation or systems	3	Short term production loss (loss of weeks) Enforcement Notice	3
		Below legal compliance	4	Death, damage to production and/or major environmental impact causing adverse publicity and fine	4
				Multiple deaths, significant damage to production causing possible permanent loss and/or major environmental impact causing significant adverse publicity	5
Severity of Outcome (S)		**Degree of Control (C)**		**Business Risk (BR)**	
Part B Significance Factor = (S) × (C) × (BR) =					

Part C Score = Part A Volume + Part B Significance Factor			
	Part A Score	**Part B Score**	
Total			
	1-40	**41-80**	**81-160**
Significance Factor	**Low**	**Medium**	**High**

On completion of the health and safety and environmental initial review a summary significance chart may be drawn up as a basis for management review/ action plan. An example of such a chart is given below:

Form B

Topic	Low	Medium	High
ENVIRONMENT			
Air emissions			
Energy			
Liquids emissions			
Solid waste			
Noise			
Raw materials			
HEALTH			
COSHH			
Manual handling			
Noise			
Vibration			
SAFETY			
Building			
Contractors			
Electrical			
Fire			
Housekeeping			
Internal transport			
M/c			

Key	Priority
High Significance	Is the highest level of priority in terms of actual or potential impact. A detailed risk assessment should be carried out forthwith and the outcomes of this further detailed assessment are the priority areas for address by the operational and improvement elements of the HS&EMS.
Medium Significance	Areas which are recognised as causing some impact. Aspects classified as being of "medium significance" will not be addressed in this current round of risk assessments. It is however, recognised that these aspects may become actionable items and should be monitored and on completion of the "high" significance topics then these will be further assessed.
Low Significance	Areas which are those aspects identified as being either irrelevant in a particular area or being of extremely low incidence or impact. It is not envisaged that the risk assessment will address these issues in the current improvement planning.

The significance rating will also be used as a basis for the audit methodology in Annex E2.

ANNEX B (informative)

ORGANISING

B.1 Policy

The health, safety and environmental policy is the driver for implementing and improving the organisation's health, safety and environmental management system so that it can maintain and potentially improve its health, safety and environmental performance.

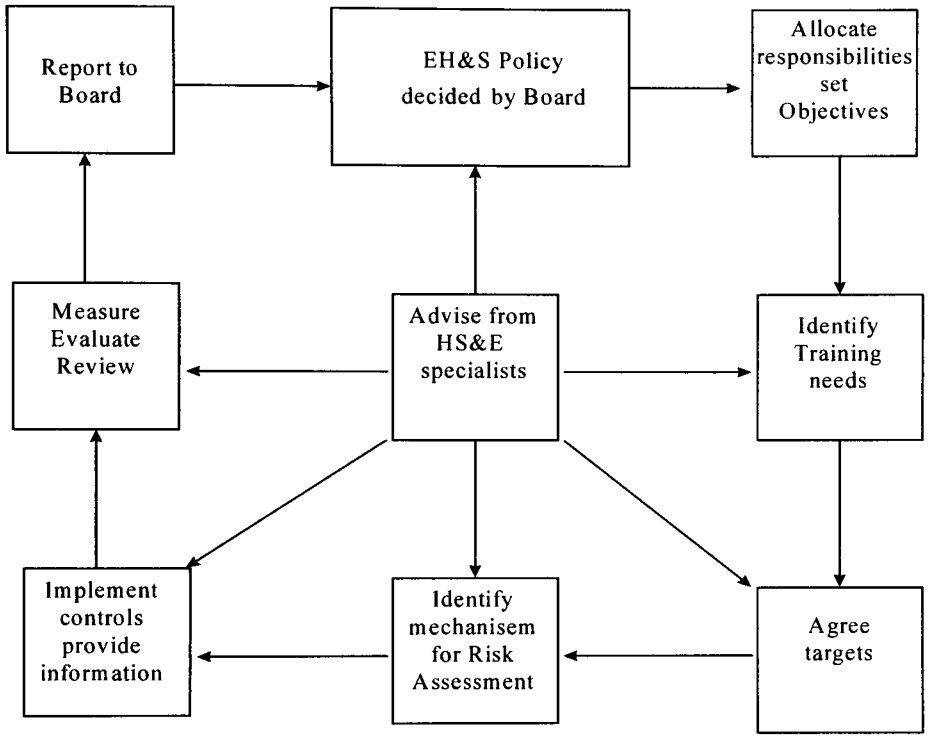
The policy should therefore reflect the commitment of top management to compliance with applicable laws and continual improvement. The policy forms the basis upon which the organisation sets its objectives and targets. The policy should be sufficiently clear to be capable of being understood by internal and external interested parties and should be periodically reviewed and revised to reflect changing conditions and information.

The policy should be developed in three separate areas:

- General Statement of Intent;
- Organisation;
- Arrangements.

NOTE—Top management may consist of an individual or group of individuals with executive responsibility for the organisation

Diagrammatic representation of a HS&E policy in a self regulating organisation



B.2 Responsibilities

B.2.1 General

At every level of the organisation, people need to be aware of their individual responsibilities, to whom they are accountable and the influence that their action or inaction can have on the effectiveness of the HS&E management system.

Responsibility and accountability for HS&E should reflect the responsibilities within the management structure.

It is important to set out people's responsibilities for health, safety and the environment. With proper consultation these are likely to reflect responsibilities for production and other aspects of the business.

Specify HS&E duties of managers and supervisors stating, for example, which departments/processes they cover. In a small firm you might simply require that the works director is responsible for all day-to-day health, safety and environmental matters and for consultation with employees. A chart showing how roles fit into the management structure may be helpful.

B.2.2 Resources—Human, physical and financial

The appropriate human, physical (e.g. facilities, equipment), and financial resources essential to the implementation of an organisation's health, safety and environmental policies and the achievement of its objectives should be defined and made available. In allocating resources, organisations can develop procedures to track the benefits as well as the costs of their health, safety and environmentally related activities. Issues such as the cost of accidents, civil claims, pollution control, wastes and disposal can be included.

B.2.3 Senior responsibilities

Identify the director with overall responsibility for health and safety.

B.2.4 Individual responsibilities

Individual responsibilities for the implementation of HS&E policy should be clearly allocated. To achieve this, the following aspects should be addressed:

a) Individual HS&E responsibilities should be clearly defined. Where job descriptions are used it may be appropriate to include such responsibilities;
b) All personnel should be given the authority and resources (including time) necessary to carry out their responsibilities;
c) Reporting relationships should be clear and unambiguous;
d) Where personal appraisal systems exist, HS&E performance should be included in the appraisal system.

Points to include:

a) Names and roles of key people such as the firm's HS&E competent person;
b) Responsibility for accident/incident investigation and reporting;
c) Who liases with the regulatory authorities e.g. Health and Safety Executive, Environment Agency, Fire Authority;
d) Who to contact (e.g. supervisor) if a health, safety or environmental problem arises;
e) Responsibility for conducting and reviewing risk assessments and for implementing any action items arising from these assessments;
f) Employees' responsibilities and action if they are not fulfilled;
g) Consultation between management and employees over matters of health, safety and environment; role and membership of any health, safety and environmental committee and frequency of meetings;
h) Responsibility for maintenance of buildings and plant.

B.2.5 The demands on line management

It should be recognised that in most cases the major burden of responsibility for carrying the H,S&E policy into effect at the workplace will fall upon line management, because the effects of failures in health, safety and the environmental controls are significant. The principle of the prevention of ill health, disease and environmental damage is a line management function requiring the same techniques of control as any other area of business activity.

For this reason it should be clearly understood when introducing the HS&E policy that the control of the decisions affecting health, safety and environment is firmly within the province of line management with functional managers acting as supporters and advisers. Line management can introduce changes with greater efficiency than functional advisers can and those changes are more likely to be of a permanent nature. This principle can be summerised as "those that create the risk, must manage the risk".

When according duties in health, safety and environment to line managers, it is important to be specific in allocation and to ensure that the recipient understands the nature of the duties, how they are to be carried out, the levels of performance expected, and where necessary, the nature of any penalties that he may incur for failing to discharge his duties. Too often, managers are happy to accept generalised commitments to health, safety and environment but are unable or unwilling to be specific about who is responsible for unsafe conditions and practice within their sphere of responsibility.

B.2.6 Employee involvement

It should be recognised that effective management of HS&E requires the support and commitment of the employees, and that the knowledge and experience of the workforce can be a valuable resource in the development and operation of the HS&E management system.

The organisation should have effective means for consultation and representation. In many organisations, HS&E consultation and representation can be successfully accommodated within the existing general management framework.

Some organisations may need to formalise their arrangements. HS&E committees provide one method of involving the workforce, but the aim should be to promote the active involvement of the workforce in all aspects of the HS&E management system. Employees should be encouraged to report shortcomings in the HS&E arrangements and be involved, where appropriate, in the development of HS&E arrangements and procedures.

B.3 Training

B.3.1 General

The organisation's HS&E management system should ensure that people at all levels are competent to carry out the duties and responsibilities assigned to them and that they receive training where necessary, especially those carrying out specialised health, safety and environmental management functions.

The organisation's HS&E management system should ensure that individuals with specific responsibilities for HS&E have the capability to effectively discharge these responsibilities, with appropriate training.

B.3.2 HS&E management system training requirements

The organisation should establish and maintain procedures for identifying training needs. The organisation should also require that contractors working on its behalf are able to demonstrate that their employees have the requisite training.

Management should determine the level of experience, competence and training necessary to ensure the capability of personnel. This may be done by:

a) Systematic identification of the competencies required by each member of staff and the training needed to remedy any shortfalls;
b) Provision of any training identified as being necessary in a timely and systematic manner;
c) Assessment of individuals to ensure that they have acquired and maintain the knowledge and skills necessary for the level of competence required;
d) The maintenance of appropriate training/skills records.

B.3.3 Elements in organisational training

All organisations should ensure that the following elements are included in training programmes:

a) An understanding of the organisation's HS&E arrangements and the individual's specific roles and responsibilities for them;

b) A systematic programme of induction and on-going training for employees and those who transfer between divisions, sites, departments, areas, jobs or tasks in the organisation. The training should include the local HS&E arrangements, the hazards, risks, precautions and procedures of work to be undertaken, before work commences;

c) A means to ensure that the training has been effective;

d) Training for all individuals who manage staff, contractors and others, e.g. temporary workers, in their responsibilities. They should subsequently understand the hazards and risks of the operations for which they are responsible, the competencies necessary to carry out the activities safely and the need to ensure that safe working procedures are followed by personnel under their control;

e) Training in risk assessment and control techniques for designers, maintenance personnel and those responsible for the development of the process or working methods;

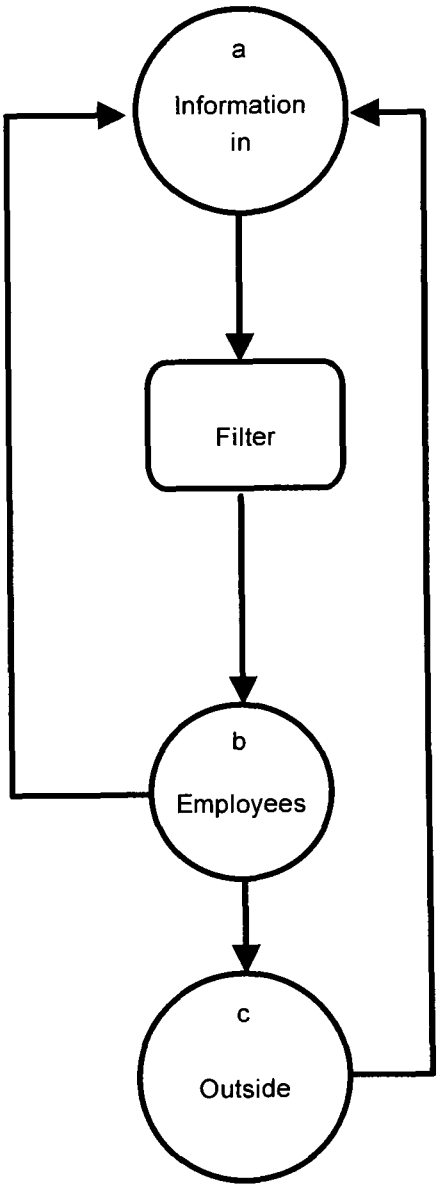
f) The roles and responsibilities of directors and senior managers for ensuring that the HS&E management system functions as necessary to control risks and minimise ill-health, injury, incident and/or other losses to the organisation.

B.4 Communications

Effective communications are an essential element of the HS&E management system. Organisations need to ensure that they have effective arrangements for the four key eliminates (a) to (d) below of effective HS&E communications:

a) Identifying and receiving relevant HS&E information from outside the organisation including:

1. New, or amendments to, existing legislation;
2. Information necessary for the identification of hazards and evaluation and control of risks, e.g. suppliers Data Sheets.
3. Information and developments in health, safety and environmental management practice.



These procedures should also address necessary communications with public authorities regarding emergency planning and other relevant issues.

b) Ensuring that HS&E information is communicated to all people within the organisation who need it. This requires arrangements to:

1. Determine information needs;

2. Ensure that these needs are met, bearing in mind the legal requirement that relevant information has to be provided in a form and manner that is comprehensible to the person receiving it;
3. Ensure that information does not just flow from "the top down", but also from "the bottom up" and across the various parts of the organisation;
4. Avoid restricting HS&E items to dedicated HS&E meetings by including them on the agenda of a variety of meetings wherever appropriate;
5. Report shortcomings in HS&E arrangements;
6. Ensure that lessons are learnt from accidents and incidents to avoid recurrence.

c) Ensuring that relevant information is communicated to people outside the organisation who require it, such as

- Requests from interested parties;
- Contractors;
- Visitors.

In some circumstances, responses to interested parties' concerns may include relevant information about the health, safety and environmental impacts associated with the organisation's operations.

d) Encouraging feedback and suggestions from employees on HS&E matters.

B.5 Documentation

B.5.1 Documentation

Documentation is a key part of any communication system and should be tailored to the needs of the organisation. The complexity of the organisation and the risks that have to be controlled will normally dictate the detail of documentation required, although it should be recognised that legal requirements demand some documentation and records.

The level of detail of the documentation should be sufficient to describe the core elements of the health, safety and environmental management system and their interaction and provide direction on where to obtain more detailed information on the operation of specific parts of this management system. This documentation may be integrated with documentation of other systems implemented by the organisation. It does not have to be in the form of a single manual.

Documentation should support the health, safety and environmental management system, not drive it. Key documents, such as working procedures, records and instructions, should be accessible at the point of use. It is necessary to ensure that people who need to refer to any of the documents or data as part of their job have correct and up-to-date versions available to them. How changes to documents and data are to be made and who has the authority to make changes should also be defined. However, the primary focus of organisations should be on the effective implementation of the environmental management system and on environmental performance and not on a complex documentation control system.

B.5.2 Records

Records are evidence of the ongoing operation of the HS&E management system and should cover:

- Legislative and regulatory requirements;
- Permits or consents;
- Results of written assessments e.g. Risk, COSHH, Noise, Manual Handling;

- Register of environmental aspects and their associated impacts;
- Health, safety and environmental training activity;
- Inspection, calibration and maintenance activity e.g. electrical equipment testing, pressure systems testing and calibration records of instrumentation used for environmental monitoring;
- Monitoring data;
- Details of non-conformance: incidents, complaints and follow-up action;
- Product identification: composition and property data;
- Supplier and contractor information;
- Health, safety and environmental audits and management reviews.

A complex range of information can result. The effective management of these records is essential to the successful implementation of the HS&EMS. The key features of good environmental information management include means of identification, collection, indexing, filing, storage, maintenance, retrieval, retention and disposition of pertinent HS&EMS documentation and records.

B.6 Specialist Advice and Services

Organisations should have access to sufficient HS&E knowledge, skills or experience to identify and manage HS&E risks effectively, and to set appropriate HS&E objectives. One or more of the following may achieve this:

a) Training managers to a sufficient level of competence to be able to manage their activities safely and keep up-to-date with developments in HS&E;
b) Employing appropriate HS&E professionals as part of the management team;
c) Engaging external specialist support where in-house expertise and/or resources are insufficient to meet the organisation's needs.

Whichever method or combination of methods is chosen, there should be adequate provision of information, resources and co-operation to ensure specialist advisers are able to discharge their duties effectively. Specific tasks and responsibilities of parties need to be clearly understood.

ANNEX C: Risk Assessment Process

C.1 When to use risk assessment procedure

The risk assessment procedure described in this annex is intended to be used:

a) Risk assessment will be prioritised on topics/process's identified in the significance review as of 'high significance'; or

b) Where hazards appear to pose a significant threat and it is uncertain whether existing or planned controls are adequate in principle or in practice;

c) Following the circumstances of an accident (over 3 day) case of ill health or unplanned release;

d) By organisations seeking continuous improvement in their HS&E management systems, in excess of minimum legal requirements.

Where risk assessments have already been undertaken prior to the initial review, they should be formally reviewed to evaluate their adequacy and plan any remedial actions identified within the action plan.

C.1.1 What is HS&E risk assessment and why do it?

The full procedure described in this annex is NOT necessary or cost-effective when it is quite clear from preliminary study that risks are trivial, or a previous assessment has shown those existing or planned controls:

1. Conform to well-established legal requirements or standards;
2. Are appropriate for the tasks;
3. Are, or will be, understood and used by everyone concerned.

Here no further action is required other than to ensure, where appropriate, that controls continue to be used.

Effort devoted to assessment of risks identified as 'low significance' in the initial review or to evaluation of standard controls will lead to the collection of more information than

can possibly be used, and to situations where important facts are lost in a mass of spurious documentation.

C.1.2 Why is risk assessment important?

The main purpose is to determine whether for all planned or existing processes, the controls are adequate and cover all significant hazards. The intention is that risks should be controlled before harm could occur.

It is recognised that risk assessments are the key foundation for pro-active HS&E management and that systematic procedures are necessary to ensure their success.

A risk assessment based on a participative approach provides an opportunity for management and the work force to agree that an organisation's HS&E procedures:

a) **Based on objective perceptions of hazards and risk**
   Potential risk assessors will have become competent. People who are too close to situations may no longer 'see' hazards, or perhaps judge risks as trivial because to their knowledge no one has been harmed. The aim should be that everyone tackles risk assessments objectively with a fresh pair of eyes and a questioning approach.

   Competent people with practical knowledge of the work activities should carry out risk assessment, preferably with colleagues from another part of the organisation who may have greater objectivity. A worthwhile approach, whenever possible, is to train small teams to carry out assessments.

b) **Involve all relevant personnel in both the assessment and the results of the outcomes**
   Ideally, everyone should contribute to assessments that relate to them. For example, they should tell assessors what they think about the need for and practicality of particular risk controls. In larger organisations a competent person, usually from within the organisation, should co-ordinate and guide the assessors' work. Specialist advice may need to be sought.

c) Are necessary and workable

Poorly planned assessments, carried out in the belief that they are a bureaucratic imposition will waste time and change nothing. Moreover, organisations may get bogged down in detail, where completion of assessment proformas becomes an end in itself

d) Implement remedial actions, which will succeed in preventing accidents, reducing incidence of occupational ill-health and prevent/minimise environmental loss

Risk assessment should provide an inventory for action and form the basis for implementing control measures.

C.2.0 Risk Assessment Initial Planning

C.2.1 Planning

If risk assessment is to be useful in practice, organisations should plan and develop a system which will:

1. Appoint a senior member of the organisation to promote and manage the activity;
2. Consult with everyone concerned, discuss what is planned to be done and obtain their comments and commitment;
3. Determine risk assessment training needs for assessment personnel/teams and implement a suitable training programme;
4. Review adequacy of assessment: determine whether the assessment is suitable and sufficient i.e. adequately detailed and rigorous;
5. Document administrative details and significant findings of the assessment;
6. Manage and prioritise actions.

Basic steps

Risk assessment involves a number of basic steps. There are three main steps:

1. Factual;
2. Judgemental; and
3. Action.

Each of which is broken down into a number of subsets as shown below.

Factual	1.	Identify the task or area
	2.	Identify the risk
	3.	Identify who or what is at risk
	4.	Identify the appropriate standards
	5.	Identify the existing control measures
Judgement	6.	Make a judgement as to whether the existing control measures meet recognised standards
Action	7.	If not prepare an action plan
	8.	Record findings
	9.	Review

C.3 Detail of Risk Assessments

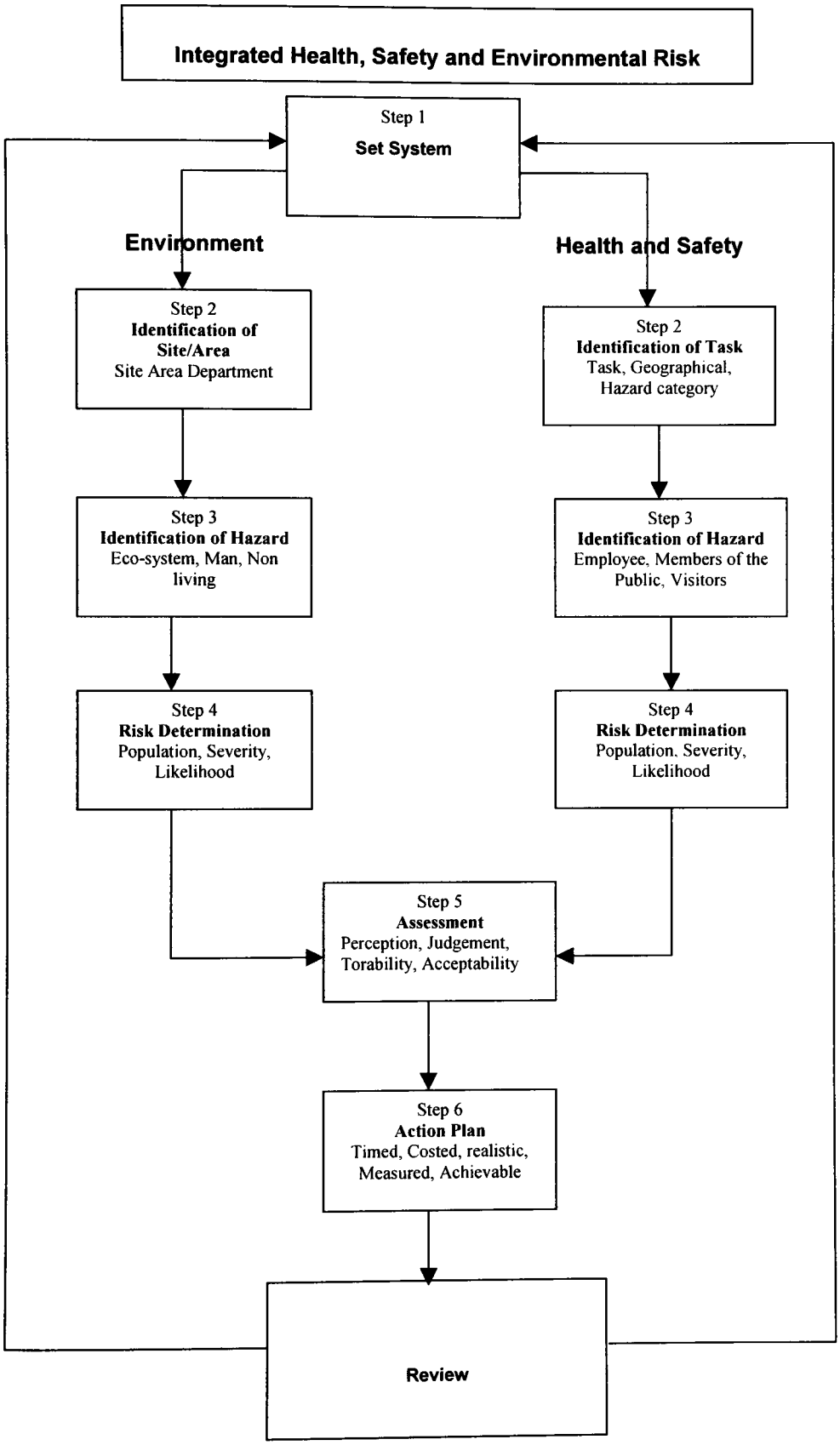
Separate health and safety and environmental assessment mechanisms

This sub-clause describes the factors that an organisation should consider when planning for risk assessment. Attention is drawn to the need to refer to relevant regulations and guidance to ensure that specific legal requirements are met.

The risk assessment process described here covers all HS&E hazards. At first sight it is better to integrate assessments for all hazards, and not carry out separate assessments for health hazards, manual handling, machinery hazards, airborne emissions and so on. In practice, however, this leads to a cumbersome and ineffective tool. Environmental risks are more effectively assessed on a more global scale i.e. departmental or site wide. Health and safety risks need to be considered at the individual task or process.

This is best illustrated by examining a production area. Each process machine will require a separate health and safety risk assessment as the standards of guarding or electrical safety will vary from one process machine to another. However, the environmental risk assessment will need to cover such issues as energy usage or noise for the complete operation and there would be no advantage in considering each separate process machine.

Whist the management of EH&S requires the same skills, the individual "tools" for HS&E risk assessment need to be kept separate for the practical reasons outlined.


Integrated Health, Safety and Environmental Risk
Step 1
Set System
Environment
Health and Safety
Step 2
Identification of Site/Area
Site Area Department
Step 2
Identification of Task
Task, Geographical, Hazard category
Step 3
Identification of Hazard
Eco-system, Man, Non living
Step 3
Identification of Hazard
Employee, Members of the Public, Visitors
Step 4
Risk Determination
Population, Severity, Likelihood
Step 4
Risk Determination
Population, Severity, Likelihood
Step 5
Assessment
Perception, Judgement, Torability, Acceptability
Step 6
Action Plan
Timed, Costed, realistic, Measured, Achievable
Review

1. Set the System (common element)

The organisation should develop a system to manage the risk assessment process which should decide the:

a. Scope;
b. Teams;
c. Times; and
d. Design of a simple risk assessment pro-forma.

1.1 Scope

It is important to decide what is to be included and what is not e.g. site based activities only or off site activities to be considered, and what operating conditions are being considered.

The assessments should be conducted under normal, abnormal and emergency operating conditions as defined below:

Normal	'standard' running plant operating conditions including the normal variations that may be expected as part of day to day running but would not be considered to be of incident status;
Abnormal	shut down and maintenance stoppages including weekends and scheduled periods;
Emergency :	this category refers to 'incidents' that may be predicted for the operational area under consideration. Incident scenarios should be proposed by process personnel and, where applicable, should be based on past incidents. Where history of incidents exist, scenarios should be developed in relation to those aspects with the greatest perceived potential significance in each issue area.

1.2 Teams

Consideration should be given at this planning stage to who will carry out the assessments? Will it be an individual or team approach? Will there be separate assessors for health and safety and environment?

1.3 Time scales

The time scales for the completion of the risk assessment process should be established with reference to the size and complexity of the organisation and the resources available. For clarity, the time scales set at this stage are for the completion of the risk assessment process only, not any remedial action identified which will be considered in the action plan.

1.4 Risk assessment pro-forma

Organisations should prepare a simple proforma that can be used to record the findings of an assessment typically covering:

Health & Safety

1. Work activity or task;
2. Hazard(s) to man;
3. Personnel at risk;
4. Likelihood of harm;
5. Severity of harm;
6. Final categorisation;
7. Controls in place;
8. Detail of legal and/or codes of practice referenced;
9. Judgement as to whether control of risk is tolerable or otherwise by comparison with steps 7 and 8 above.

The Environment

1. Site and departmental activity;
2. Scope of environmental significant hazards;
3. Consequences of harm;
4. Magnitude of harm;
5. Final categorisation;
6. Controls in place;
7. Detail of legal and/or codes of practice referenced;

8. Judgement as to whether control of risk is tolerable or otherwise by comparison with steps 6 and 7 above;
9. Action to be taken following the assessment.

Both systems should contain basic administrative details, such as the name of the assessor, date, etc.

Organisations should develop their overall risk assessment procedure and may need to carry out trials and review the system. If subsequent changes are made to the forms then it should still be possible to extract relevant information for comparative purposes. A suggested procedure and risk assessment form is included (see C.7) for guidance.

2.0 Identification of Scope: Area/Task (Separate Elements)

2.1 Environmental Site Identification

Site Assessment

Some of the categories can only realistically be assessed on a site basis. Examples are:

Land Contamination

Assessment of land contamination will be conducted by reference to the following :

- Visual assessment of the site;
- Review of the contaminated land assessment report;
- Reviews of ground water quality checks at the borehole or similar, situated adjacent to the site;
- Review of storage arrangements.

A professional judgement will then be made as to the likelihood of land contamination on the site. This judgement will be reviewed annually as part of the review of the significant environmental aspects register.

Visual Impact

The assessment of the significance of the visual impact of the plant will be made by reference to the locality and surrounding developments. In addition, compliance with planning consents issued by the local authority for the site, should be assessed.

Ecosystem Disruption

Ecosystem disruption will be dealt with under the other environmental aspects considered during this assessment procedure. The justification for this is that if the environmental aspects (the sources) are found to be significant then ecosystem impacts (the targets), either locally or globally, may be assumed to be affected to some degree as a consequence. This approach seems logical, especially given that there are no areas of notable conservation or scientific interest in the near vicinity of the plant.

External transport

The assessment of the significance of external transport of the plant will be made by reference to the volume and journey type.

Departmental Assessment

For the purposes of assessment of significant direct environmental impacts, the plant is divided into the operational areas. This division is primarily to ease the detailed assessment of such a large and varied site and on a small site this may not be necessary. Details of these assessments are given below :

For each department the following environmental issue areas are assessed for significance: air emissions, energy usage, liquid wastes, noise, solid waste and raw material usage.

2.2 Health and Safety Task/Activity Identification

A necessary preliminary to risk assessment is to prepare a list of work activities, to group them in a rational and manageable way, and to gather necessary information about them. The assessments are conducted under normal, abnormal and emergency operating conditions. Possible ways of classifying work activities include:

1. Site and departmental activities;
2. Geographical areas within/outside the organisation's premises;
3. Stages in the production process, or in the provision of a service;
4. Planned and reactive work;
5. Defined tasks (e.g. driving).

3. Identification of Hazard (Separate Elements)

3.1 Environmental Significance (separate elements)

Three questions enable hazard identification:

- Is there a source of harm? Consider factors such as:
  - — Toxicology, immunotoxicity, pathogenicity, mutagenicity, teratogenicity and carcinogenicity;
  - — Potential for long-lived presence in the environment including the potential to bioaccumulate and bioconcentrate;
  - — Potential for effects on environmental processes such as photosynthesis, the nitrogen and carbon cycles;
  - — Potential for effects on air (including upper atmosphere), water and soil;
  - — Potential for affecting ecosystem function, such as influence on predator/prey relationships or changes in population numbers of the species in an ecosystem;
  - — Potential for causing offence to people or adverse effects on them; and
  - — Potential for accidents.

- Who (or what) could be harmed? Including man, the eco-system and the non-living environment?
- How could harm occur?

3.2 Health & Safety Hazard Identification (separate element)

Three questions enable hazard identification:

- Is there a source of harm? Consider factors such as;
  - — Toxicology, Immunotoxicity, pathogenicity, mutagenicity, teratogenicity and carcinogenicity;
  - — Potential for accidents;
  - — Ill health such as asthma's.
- who (or what) could be harmed? e.g. operator, contractor, members of the public.
- how could the harm occur? e.g. release of chemicals, collapse of scaffolding.

4. Risk Determination (Separate Elements)

4.1 Environmental Risk Determination (separate elements)

The risk from the hazard should be determined by estimating the potential severity of harm and the likelihood that harm will occur.

4.1.1 EVALUATION

For the living environment

For the living environment other than humans, it can be useful to consider the effect that a particular hazard, if realised, could ultimately have on populations of organisms and/or on endangered or beneficial species:

- **Severe:** a significant change in the numbers of one or more species including beneficial and endangered species, over a short or long term. This might be a reduction or complete eradication of a species, which for some organisms could lead to a negative effect on the functioning of the particular ecosystem and/or other connected ecosystems;
- **Moderate:** a significant change in population densities, but not a change which resulted in total eradication of a species or had any effect on endangered or beneficial species;
- **Mild:** some change in population densities, but without total eradication of other organisms and no negative effects on ecosystem function;
- **Negligible:** no significant changes in any of the populations in the environment or in any ecosystem functions.

For the non-living environment:

To assess the magnitude of consequences for the non-living environment a similar approach may be taken to that for the living environment:

- **Severe** effects might be irreparable damage to geological features;
- **Moderate** effects might be damage to structures which are present in limited numbers (such as Grade II listed buildings);
- **Negligible** effects might be very slight damage to such structures.

4.1.2 ESTIMATION

A simple matrix shown below can be used to quantify the outcome of this process in terms of the overall potential for harm to the environment including man, the eco-system and the non-living environment.

	Consequences			
	Severe	**Moderate**	**Mild**	**Negligible**
Probability				
High	High	High	Medium/low	Near zero
Medium	High	Medium	low	Near zero
Low	High/medium	Medium/low	low	Near zero
Negligible	High/medium /low	Medium/low	low	Near zero

4.2 Health & Safety Risk Determination (separate elements)

4.2.1 SEVERITY

For the human being, it can be useful to consider the nature of the harm, ranging from slightly to extremely harmful:

- **extremely harmful:** amputations; major fractures; poisonings; multiple injuries; fatal injuries; occupational cancer; other severe life shortening diseases; acute fatal diseases such as allergic asthma;
- **Harmful:** lacerations; burns; concussion; serious sprains; minor fractures: deafness; dermatitis; asthma; work related upper limb disorders; ill-health leading to permanent minor disability such as non-allergic asthma;
- **slightly harmful:** superficial injuries; minor cuts and bruises; eye irritation from dust; nuisance and irritation (e.g. headaches); ill-health leading to temporary discomfort.

4.2.2 Likelihood of Harm

Likelihood considers how frequently the hazardous activity/task/event take place. Clearly, the more often the event, despite any mitigating control measures, then the greater chance of an incident occurring.

4.2.3 Numbers of people affected

These subjective risk estimations should normally take into account all the people exposed to a hazard. Thus any given hazard is more serious if it affects a greater number of people. But some of the larger risks may be associated with an occasional task carried out just by one person, for example maintenance of inaccessible parts of lifting equipment, and this should be taken into account.

4.2.4 Risk Assessment (Common Element)

All the above stages can be considered as information gathering only. A judgement is now required:

Does the level of control in place reduce the risk to an acceptable level?

There are many factors which will have to be taken into account in objectively assessing the level of risk and the control measures, which will include:

Factors affecting judgement of risk

a) Perceived Risk

Risk perception involves peoples' beliefs, attitudes, judgements and feelings, as well as the wider social or cultural values and dispositions that people adopt towards hazards and their benefits. Furthermore, the perception of risk is multidimensional, with a particular hazard meaning different things to different people (depending, for example, upon their underlying value systems) and different things in different contexts. In some circumstances, important aspects of risk perception and acceptability involve judgements not just of the physical characteristics and consequences of an activity but also social and organisational factors such as the credibility and trustworthiness of risk management and regulatory institutions. For example, workers will often perceive comfort issues above safety or ill health and evaluate for example excessive heat or cold working conditions as a higher priority to the release of excessive styrene fumes into the atmosphere. What is clear is that risk perception cannot be reduced to a single subjective correlate of a particular mathematical model of risk, such as the product of probabilities and consequences, because this imposes unduly restrictive assumptions about what is an essentially human and social phenomenon.

Objective perception is based upon an individual's knowledge and information. Risk assessment should be as objective an exercise as possible by direct comparison with previously agreed detailed standards.

Other factors known to affect an individual's perception of risk include:

Familiarity

People tend to underestimate the risks which are familiar to them and to overestimate those that are unfamiliar. Hence the phrase "familiarity breads contempt." Thus the practitioners of soccer and hang gliding have a fair idea of the risks they take but the general public under-estimates the risks of an accident in soccer and overestimates the risks of one in hang gliding.

Control

People tend to underestimate the risks from an activity over which they have control compared to one in which they are in other people's hands. Despite published statistics on fatalities, driving a car is often considered to be safer than flying in an airplane. Moreover, people tend to demand greater protection from events over which they have no control e.g. large-scale chemical plant.

Proximity in space

People may overestimate the risks of something, which might occur near to them and underestimate those that will occur at a location remote from them. This is one factor in the "Nimby" (Not In My Back Yard) syndrome e.g. building of a motorway.

Proximity in time

People tend to ignore the effects of risks that are going to arise much later in time. For example, the wearing of hearing protection to prevent long term occupational deafness is often not appreciated by the persons exposed to the noise source. However, the need to maintain a guard to protect the operator from the dangerous parts of a machine will be more readily appreciated.

The dread factor

People exaggerate the risks associated with phenomena they do not understand. Risks associated with machinery are under-regarded whilst those associated, e.g. radiation, are exaggerated. Moreover, people tend to demand greater protection from events which they do not understand.

The scale factor

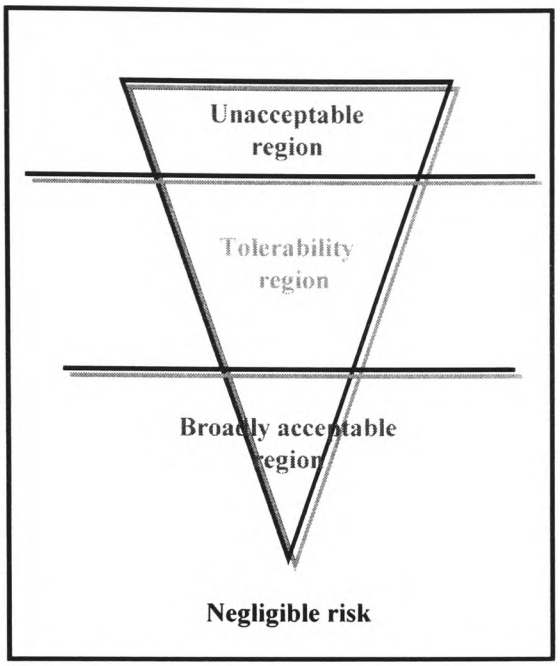
The media are more concerned with one large-scale consequence than a large number of individually smaller consequences which sum to a greater overall consequence. An obvious example is in car accidents where a pile-up causing 50 injuries is more newsworthy than 50 separate accidents each causing an injury. A consequence of the greater media attention to large-scale accidents is that they concern politicians and businesses more.

General confidence in the risk assessment and evaluation process is another factor to be considered. However open the process may be those not directly involved or benefiting from the intention will suspect special pleading. It is one thing to check over a document for untruths but it is much harder to identify matters that have been entirely omitted. If, for example, an undertaking wished to present an operation as environmentally acceptable, it could easily conceal a hazard it wished not to be taken into account.

b) Acceptability of risk at work (Tolerability of Risk)

The judgement on what is a tolerable risk from a work activity should be taken as the starting point for considering up-to-date good practice and standards. The philosophical framework tolerability of risk (TOR) determines which risks are considered as unacceptable, tolerable and broadly acceptable and can also prove invaluable, particularly where there are no standards or good practice to latch on to. TOR has gained considerable acceptance within industry because it helps to provide the basis for justifying decisions whereby risks are judged to be worth the benefits.

The framework is illustrated in the figure below. It involves acceptance of an upper limit above which a particular risk is regarded as unacceptable. This upper limit is taken to be a chance of death of 1 in 1,000 per annum for workers and 1 in 10,000 per annum for members of the public.



LEVELS OF RISK AND ALARP

Below the upper limit is a region where a balance has to be struck between the costs and demonstrated benefits of any increment to the existing level of safety, i.e. of risk reduction. There must, of course, be confidence that a risk is actually being controlled at the relevant level, known as ALARP (as low as reasonably practicable). The lowest point at which it would be considered sensible to address any risk would be where the chance of death was about one in a million per year.

Cost benefit analyses (C.B.A's) are very useful here. However, this does involve putting a monetary value on specified levels of harm where individual risk is involved. The UK, for example, generally makes use of the value of life figure adopted by the Department of Transport (about £3/4m in 1998) for appraisal of new road schemes.

However, to calculate the acceptability of societal risks a higher figure is often used. For example in most large catastrophes a great deal more than human life is destroyed, e.g. property and political costs are also incurred, including the frequently very high costs of restoring public confidence. From a rather different standpoint, it seems clear that the

public are very averse to certain kinds of risks, particularly those kinds where there is no escape and no warning, with no free play for the operation of individual judgement.

The detailed evaluation of societal risks is thus likely to be a complex question. A convenient method of analysis is to apply an aversion factor to the value of life figure for individual risk. For societal risks, it is usually three times the amount of the value for life attributed to individual risks.

The treatment of uncertainty is also of great importance in all risk and cost calculations. It leads to the view that the ALARP calculation should be biased in favour of greater safety where risks are considerable. One can adopt a 'scientific' approach in which the value of life and the tolerability of risk factor are used to calculate a value for the control measures required. However, British case law indicates that this approach will not normally succeed in Britain as it is believed that the factor described as 'gross disproportion,' in case law, relating to duties qualified by such as 'reasonably practicability,' should apply - i.e. more should be paid to avert the risk than would be indicated by the standard value of life. This is because any calculation does not account for the uncertainty or unknown factors, which may be present.
All the above factors will 'colour' the judgement of the assessors. In forming the judgements the 'variability' factors of risk judgement has been examined. The other side of the equation are 'the control measures.'

Control measures

The control measures will include:

- Hardware controls;
- Systems of work, procedures etc.;
- Training and level of competence of operators.

Human error must be accounted for when making judgements as to whether control or otherwise has been achieved. It is important to recognise an allowance for this human error and arbitrarily an allowance of a factor of ten is often used.

4.2.5 For Health and Safety

Control hierarchy

Controls should be chosen taking into account the following:

1. If possible, eliminate hazards altogether, or combat risks at source, e.g. use a safe substance instead of a dangerous one;
2. If elimination is not possible, try to reduce the risk, e.g. by using a low voltage electrical appliance;
3. Where possible, adapt work to the individual, e.g. to take account of individual mental and physical capabilities;
4. Take advantage of technical progress to improve controls;
5. A blend of technical and procedural controls is usually necessary;
6. The need to introduce planned maintenance of for example, dust collectors;
7. Adopt personal protective equipment only as a last resort, after all other control options have been considered.

The link has been established between:

- Levels of risk;
- Control measures.

Now evaluation of risk has to be considered:

Decide if the risk is adequately controlled: the "judgement" phase

To evaluate whether the risk is tolerable it will be necessary to make a judgement on the task/activity being considered, whether the current control measures already implemented and complied with are adequate for the level of risk identified. Legal requirements and codes of practice are good guides as to whether control has been achieved or otherwise. Reference will have to be made to the minimum legal standard terminology such as:

Environment	
ALARA	As low as reasonably achievable
ALARP	As low as reasonable practicable
BATNEEC	Best available technique not entailing excessive cost
BPEO	Best practicable environmental option
BPM	Best practicable means
Health and Safety	
SFARP	So far as is reasonably practicable
	Practicable
	Absolute Duty

Calculating levels of risk

It is generally not necessary to make precise numerical calculations of risk. Complex methods for quantified risk assessment are normally only required where the consequences of failure would be catastrophic. Risk assessment in major hazard industries is related to the approach required in other workplaces, but in most organisations much simpler subjective methods are appropriate.

An environmental and health and safety simple method for estimating risk levels is illustrated on page 251 of this section. Risks are classified according to their estimated likelihood and potential severity of harm. Some organisations may wish to develop

more sophisticated approaches, but this method is a reasonable starting point. Numbers may be used to describe risks, instead of the terms 'moderate risk', 'substantial risk', etc. Using numbers does not confer any greater accuracy to these estimates.

It will also be necessary to consider if using a quantified approach whether to calculate the "raw" risk before the controls are applied and then again recalculate after the controls have been considered. This will give two comparative values to assist in determining whether the risk control is now tolerable or not.

Alternatively the calculation of the residual risk after all control measures have been considered may be sufficient to determine tolerability or not.

4.2.6 Risk Assessment

Having made judgements of:

- The level of risk;
- The current control measures;
- Relevant standards.

A final judgement as to whether the level of risk is acceptable or otherwise can now be made.

Where the judgements identify remedial action are required, then these actions can be considered in terms of:

- Time-scales;
- Long and short term measures;
- Priorities;
- Costs.

4.2.7 Prepare a Risk Control Action Plan (common element)

Risk categories form the basis for deciding whether improved controls are required and the time scale for action. An approach, again suggested as a starting point, recommends that control effort and urgency should be proportional to risk.

The outcome of a risk assessment should be an inventory of actions, in priority order, to devise, maintain or improve controls. Whenever possible, the action plan itself should be:

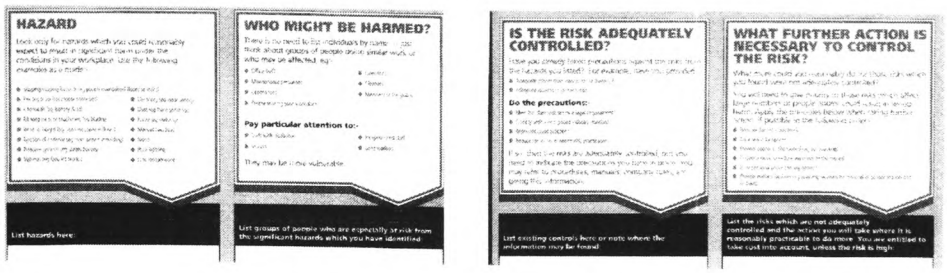
- Specific;
- Measurable;
- Achievable;
- Relevant;
- Timed.

The list of key objectives should be prioritised. Consideration should also be given to objectives in themselves that are not high-risk, but nevertheless can be achieved relatively easily and cheaply.

4.2.8 Changing Conditions and Revising

Risk assessment should be seen as a continuing process. Thus, the adequacy of control measures should be subject to continual review and revised if necessary. Similarly, if conditions change to the extent that hazards and risks are significantly affected then risk assessments should also be reviewed.

Example of a Risk Assessment form (HSE: 1995)



A Simple Health and Safety Risk Rating Table

Severity	Score	
High	**3**	Amputations; major fractures; poisonings; multiple injuries; fatal injuries; occupational cancer; other severe life shortening diseases; acute fatal diseases.
Medium	**2**	Lacerations; burns; concussion; serious sprains; minor fractures; deafness; dermatitis; asthma; work related upper limb disorders; ill-health leading to permanent minor disability.
Low	**1**	Superficial injuries; minor cuts and bruises; eye irritation from dust; nuisance and irritation (e.g. headaches); ill-health leading to temporary discomfort.

Likelihood	Score	
High	**3**	Hourly, repeatedly
Medium	**2**	Daily
Low	**1**	Monthly, occasionally

Multiply the Likelihood and Severity ratings to obtain an overall significance rating

Significance = Severity × Likelihood

Score	9-6	5-3	2-1
Significance	**High**	**Low**	**Not**

	Severity		
Likelihood	**High**	**Medium**	**Low**
High	High	High	Low
Medium	High	Low	Not
Low	Low	Not	Not

A Simple Environmental Risk Rating Table

Frequency		Legislation	
0	Never occurs	0	No relevant legislation
1	Occurs every 2 years - life of site	1	Indirect legislation
2	Occurs every week – 2 years	2	Within direct legislation
3	Occurs every week – 10 weeks	3	Bordering direct legislation
4	Occurs continuously – every week	4	Exceeds direct legislation
Damage		**Concern**	
0	No damage	0	No public concern
1	Insignificant damage	1	Limited public concern, no local concern
2	Damage of minor local significance	2	Limited public concern generally and locally
3	Damage of major local significance	3	Limited public concern, major local issue
4	Damage to regional/national significance	4	General concern and major local issue-organisation reputation at stake

ANNEX D

D.1 Emergency Procedures

D.1.1 Emergency preparedness and response

Emergency plans and procedures should be established to ensure that there will be an appropriate response to unexpected or accidental incidents.

The organisation should define and maintain procedures for dealing with health, safety or environmental incidents and potential emergency situations. The operating procedures and controls should include, where appropriate, consideration of:

- Accident;
- Dangerous occurrence;
- Occupational illness or disease;
- Accidental emissions to the atmosphere;
- Accidental discharges to water and land;
- Specific environment and ecosystem effects from accidental releases.

N.B.
The procedures should try to anticipate control or mitigation measures to take into account incidents arising, or likely to arise, as consequences of:

- Abnormal operating conditions;
- Accidents and potential emergency situations.

Emergency plans may include:

- Emergency organisation and responsibilities;
- A list of key personnel;
- Details of emergency services (e.g. Fire Department, spill clean-up services);
- Internal and external communication plans;
- Actions taken in the event of different types of emergencies;

- Information on hazardous materials including measures to be taken in the event of accidental release;
- Training plans and testing for effectiveness.

D.1.2 Hazardous Event Investigation

D.1.2.1 Investigation procedure

Organisations should have effective procedures for reporting and investigating hazardous events. The prime purpose of the investigation procedure is to prevent further hazardous events. The occurrence of a hazardous event is usually evidence of HS&E management system failures. Therefore, the following should be investigated:

- Why an accident or incident happened;
- Shortcomings in the HS&E system and 'sharp end' failures.

Hazardous event investigation should address questions of:

- What happened; and
- Why it happened.

The procedure should include:

a) Type of events to be investigated (e.g. 'near misses' that could have led to serious harm);
b) Where appropriate, co-ordination with emergency plans and procedures;
c) The purpose of investigations;
d) The scale of investigative effort in relation to the potential or actual harm;
e) Who is to investigate, their authority, required competencies and associated training needs (including line management);
f) Arrangements and location for witness interviews;
g) Practical issues, such as availability of cameras and storage of evidence;
h) Investigation reporting arrangements, including statutory reporting requirements;
i) Investigation personnel should begin their preliminary analyses of the facts while further information is collected. Data collection and analysis should

continue until an adequate and sufficiently comprehensive explanation is obtained;

j) Reporting of the incident when required, to the appropriate regulatory authorities.

D.1.2.2 Sources of information

Those investigating hazardous events should consider critical:

a) Reactive monitoring data;
b) Results of risk assessments and choice of controls;
c) Implementation of controls as determined by pro-active monitoring data.

D.1.2.3 Possible HS&E shortcomings

Investigators should consider whether the hazardous event was associated with one or more of the following:

a) Risk controls selected on the basis of an unsuitable or insufficient risk assessment;
b) Poor implementation of controls;
c) Failures of pro-active monitoring to detect poor implementation of controls;
d) Controls implemented but ineffective;
e) Failures of reactive monitoring to detect near misses that would have revealed ineffective controls;
f) Controls not reviewed or improved in the light of evidence of pro-active and/or reactive monitoring;
g) Failure to manage change effectively.

Learning from and communicating results of investigations.

The organisation should learn from the investigation, which should:

a) Identify root causes in the HS&E and general management of the organisation;
b) Communicate findings to all relevant parties;
c) Include relevant findings from investigations.

In conformity with the requirements of this standard, implementation of remedial controls should be monitored to ensure timely and effective change.

The findings, conclusions, and recommendations reached as a result of these investigations should be documented, and the necessary corrective and preventive actions identified. Management should ensure that these corrective and preventive actions have been implemented and that there is systematic follow-up to ensure their effectiveness.

D.2 Systems and Procedures

Systems and procedures should be properly codified and indexed. It is recommended that the pages of the company's health, safety and environmental manual are coloured by subject and that the manuals are loose leaf for the purpose of revision and for the making up of relevant sets of instructions for sub-contractors and plant installers.

It is important that each person receives only the systems and arrangements which are relevant to his own particular activity and place of work. The accumulation of irrelevant written material quickly begets contempt. Systems of work stand or fall by the accuracy and care with which they are regularly examined and controlled.

There is always a danger that in the course of time, formal arrangements for health, safety and environmental issues become subtly degraded and tacitly ignored, both by line management and by operatives, corners are cut and risks are taken. Senior management and those with particular management responsibilities for the HS&E management system should systematically and regularly look for signs of this and ensure that it is drawn to the attention of all relevant management.

Annex E (informative)

E.1 Measurement and evaluation

E.1.1 General

Measuring, monitoring and evaluating are key activities of a health, safety and environmental management system, which ensure that the organisation is performing in accordance with the stated policy.

An organisation's performance measurement system should incorporate both pro-active and reactive monitoring as follows:

a) Pro-active monitoring should be used to check compliance with the organisation's HS&E activities, for example to confirm that recently appointed staff have attended an induction course;
b) Reactive monitoring should be used to investigate, analyse and record HS&E management system failures - including accidents and incidents;
c) It is often necessary to use both pro-active and reactive monitoring data as outcome indicators. Outcome indicators are used to determine whether objectives are achieved.

E.1.2 Measuring and monitoring

There should be a system in place for measuring and monitoring actual performance against the organisation's stated health, safety and environmental objectives and targets in the areas of HS&E management system and operational processes. This includes evaluation of the quality of the risk assessments being undertaken to ensure that "the judgement of control" is at a minimum in compliance with relevant health, safety and environmental legislation and regulations. The results should be analysed and used to determine areas of success and to identify activities requiring corrective action and improvement.

E.1.3 Selecting outcome indicators

Identifying appropriate health, safety and environmental performance indicators for the organisation should be an ongoing process. Such indicators should be objective, measurable, verifiable and reproducible. They should be relevant to the organisation's activities, consistent with its health, safety and environmental policy, practical, cost-effective, and technologically feasible.

Examples of performance measures that an organisation could adopt to monitor HS&E performance are shown below. However, organisations should develop a range of measures relevant to their particular circumstances.

Information needs will vary at different levels and in different parts of an organisation. For example, senior staff need key performance indicators to confirm that the HS&E system is working effectively. At the operational level many performance indicators may be necessary to monitor implementation and effectiveness of risk controls. Large organisations should develop a system where measurement summaries are reported upwards to senior staff.

Selecting appropriate outcome indicators depends on the chosen objectives. The following are examples of pro-active and reactive outcome indicators relevant to a range of objectives. The lists include examples of both quantitative and qualitative monitoring data. The list is not exhaustive, but given for illustrative purposes only.

Examples of pro-active monitoring data

a) The extent to which plans and objectives have been set and achieved;
b) Staff perceptions of management commitment to HS&E;
c) Whether a director for HS&E has been appointed and who do they report to;
d) Whether HS&E specialist staff have been appointed;
e) The extent of influence of HS&E specialists;
f) Whether the health, safety and environmental policy has been adequately communicated;

g) Number of risk assessments completed as a proportion of those required together with an indication of identified actions completed;
h) Extent of compliance with risk controls;
i) Extent of compliance with statutory requirements;
j) The number and effectiveness of senior managers' HS&E tours;
k) The number of staff suggestions for HS&E improvements;
l) Staff attitudes to risks and risk controls;
m) Staff understanding of risks and risk controls;
n) Frequency of HS&E audits;
o) Time to implement HS&E audit recommendations;
p) Frequency and effectiveness of HS&E committee meetings;
q) Frequency and effectiveness of staff HS&E briefings;
r) Time to implement action on complaints or suggestions;
s) Health surveillance reports;
t) Personnel exposure sampling reports;
u) Workplace exposure levels (e.g. noise, dust, fumes);
v) Environmental release monitoring;
w) Results of environmental monitoring such as stack emissions;
x) Visual appearance;
y) Ecological impact surveys;
z) Neighbourhood surveys;
aa) Public external body views such as Friends of the Earth etc.

Examples of reactive monitoring data:

a) Unsafe acts;
b) Unsafe conditions;
c) Near misses;
d) Damage only accidents;
e) Reportable dangerous occurrences;
f) Lost-time accidents - when at least one work shift (or other time period) is lost by a person as a result of an accident in jury;
g) Sickness absences - employee absences due to illness (occupationally-related or non-occupationally-related);

h) Releases to the environment (e.g. spillage's failure of controls etc.);

i) Complaints made, (e.g. by members of the public);

j) Criticisms made by regulatory agency staff;

k) Regulatory agency enforcement action;

l) Equipment product damage.

E.2 Management Review

E.2.1 General

A continual improvement process should be applied to the health, safety and environmental management system to achieve overall improvement in performance.

E.2.2 Review of the Health, Safety and Environmental Management System

The organisation's management should, at appropriate intervals, conduct a review of the HS&E management system to ensure its continuing suitability and effectiveness.

The review of the HS&E management system should be broad enough in scope to address the health, safety and environmental dimension of all activities, products or services of the organisation, including their impact on financial performance and possibly competitive position.

The review of the HS&E management system should include:

- A review of health, safety and environmental objectives, targets and health, safety and environmental performance;
- Findings of the HS&E management system audits;
- An evaluation of its effectiveness;
- An evaluation of the suitability of the health, safety and environmental policy and the need for changes in the light of:
    - — changing legislation;
    - — changing expectations and requirements of interested parties;
    - — changes in the products or activities of the organisation;

— advances in science and technology;

— lessons learned from environmental incidents;

— reporting and communication.

E.2.3 Continual Improvement

The concept of continual improvement is embodied in the HS&E management system. It is achieved by continually evaluating the health, safety and environmental performance of the management system against its policies, objectives and targets for the purpose of identifying opportunities for improvement.

E.3 Audit

This annex provides guidance on how to set up and operate a health, safety and environmental audit system. The purpose of an audit is to test the effectiveness of the management system against its own pre-determined targets, systems and procedures.

An example of an audit questionnaire, which supports the management system, is attached in appendix 3 for information. This can be used as a stand alone audit, without implementing the management system. However, it does not provide a ready-to-implement system as it will in general be necessary to tailor any system to the needs and size of the organisation.

E.3.1 Audit Objectives

An HS&E management system audit should have defined objectives. Examples of typical objectives are as follows:

- To determine that the control standards of HS&E noted during the audit conform at least to minimum legal standards;
- To determine whether the auditee's HS&E management system has been properly implemented and maintained;
- To identify areas of potential improvement in the auditee's HS&E management system;

- To assess the ability of the internal management review process to ensure the continuing suitability and effectiveness of the HS&E management system.

E.3.2 Audit Scope

The audit scope describes the extent and boundaries of the audit in terms of factors such as physical location and organisational activities as well as the manner of reporting. The scope of the audit will determine how many of the elements of the complete management system will be sampled. The client and the lead auditor will determine these factors. The auditor should normally be consulted when determining the scope of the audit. Any subsequent changes to the audit scope require the agreement of the client and the lead auditor.

The resources committed to the audit should be sufficient to meet its intended scope.

E.4 Commitment to Auditing

E.4.1 Senior Management Commitment

Auditing is an essential element of a health, safety and environmental management system, not a substitute for it. For health, safety and environmental auditing to be of value, senior management should be fully committed to the concept of auditing and to its effective implementation within the organisation. This includes a commitment not to reject audit findings and recommendations without good reason and to take appropriate action within a reasonable time, according to the level of risk identified. This should recognise that once they have agreed that an audit should be carried out, it should be completed without interference and without any attempt to influence or coerce the auditors.

E.4.2 Co-operation with Auditors

Often staff at all levels see audits as a threat for a number of reasons including the fear of criticism. They should be made aware of the purposes of auditing and the benefits. They should be required to be open and to co-operate fully with the auditors, and to respond to their questions honestly. This can be assisted by ensuring that audits are seen as part of a continual improvement process and development of a 'no blame' culture, not just a means of identifying problems of the HS&E management system.

E.5 Roles, Responsibilities and Activities

E.5.1 Team Auditing

It is strongly recommended that the audit is completed by an audit team, rather than an individual auditor. The team approach brings greater benefits such as:

- A broader range of skills and experiences to draw from;
- Each audit member can select a particular aspect to audit both vertically and horizontally within an organisation;
- The audit takes less time on site;

- The audit team benefits from the discussions to ensure continuity and balance of the audit findings.

The potential disadvantages of team audits are:

- It requires a significant commitment of site personnel resources to assist the audit team whilst they are on-site;
- It can appear to be 'mob handed' and as a result intimidating to employees.

E.5.2 Lead Auditor

The lead auditor is responsible for ensuring the efficient and effective conduct and completion of the audit within the audit scope and plan approved by the client.

In addition, responsibilities and activities of the lead auditor should cover:

a) Consulting with the client and the audit, if appropriate, in determining the criteria and scope of the audit;
b) Obtaining relevant background information necessary to meet the objectives of the audit, such as details of the auditee's activities, products, services, site and immediate surroundings, and details of previous audits;
c) Forming the audit team, giving consideration to potential conflicts of interest, and agreeing on its composition with the client;
d) Directing the activities of the audit team;
e) Preparing the audit plan with appropriate consultation with the client, audit and audit-team members;
f) Communicating the final audit plan to the audit team, audit and client;
g) Co-ordinating the preparation of working documents and detailed procedures, and briefing the audit team;
h) Seeking to suggest solutions to any problems of the HS&E management system that arise during the audit;
i) Recognising when audit objectives become unattainable and reporting the reasons to the client and the audit;

j) Representing the audit team in discussions with the audit, prior to, during and after the audit;
k) Notifying the organisation without delay, of audit findings of critical non-conformities;
l) Reporting to the client on the audit clearly and conclusively within the time agreed with in the audit plan;
m) Making recommendations for improvements to the HS&E management system, if agreed in the scope of the audit. Where major and potentially serious breaches of minimum legal standards are noted, then recommendations for immediate corrective action should be made.

E.5.3 Auditor

Auditor responsibilities and activities should cover:

a) Following the directions of and supporting the lead auditor;
b) Planning and carrying out the assigned task objectively, effectively and efficiently within the scope of the audit;
c) Collecting and analysing relevant and sufficient audit evidence to determine audit findings and reach audit conclusions regarding the HS&E management system;
d) Preparing working documents under the direction of the lead auditor;
e) Documenting individual audit findings;
f) Safeguarding documents pertaining to the audit and returning such documents as required;
g) Assisting in writing the audit report.

E.5.4 Audit Team

The process for selecting audit-team members should ensure that the audit team possess the overall experience and expertise needed to conduct the audit.

Consideration should be given to:

a) Qualifications as given, for example, in ISO 14012;

b) The type of organisation, processes, activities or functions being audited;
c) The number, language skills and expertise of the individual audit-team members;
d) Any potential conflict of interest between the audit team members and the audit;
e) Requirements of clients, and certification and accreditation bodies.

The audit team may also include technical experts and auditors-in-training that are acceptable to the client audit and lead auditor.

E.5.5 Client

Client responsibilities and activities should cover:

a) Determining the need for the audit;
b) Contacting the audit team to obtain its full co-operation and initiating the process;
c) Defining the objectives of the audit;
d) Selecting the lead auditor or auditing organisation and, if appropriate, approving the composition of the audit team;
e) Providing appropriate authority and resources to enable the audit to be conducted;
f) Consulting with the lead auditor to determine the scope of the audit;
g) Approving the HS&E management system audit criteria;
h) Approving the audit plan;
i) Receiving the audit report and determining its distribution;
j) Implementing agreed actions;
k) Determining next date for audit.

E.5.6 Audit

The responsibilities and activities of the audit should cover the provision of the following:

- Informing employees about the objectives and scope of the audit as necessary;

- Providing the facilities needed for the audit team in order to ensure an effective and efficient audit process;
- Appointing responsible and competent staff to accompany members of the audit team, to act as guides to the site and to ensure that the audit team is aware of health, safety and other appropriate requirements;
- Co-operating with the audit-team to permit the audit objectives to be achieved;
- Receiving a copy of the audit report unless specifically excluded by the client.

E.6 The Audit Process

E.6.1 Initiating the audit

E.6.1.1 Preliminary document review

Prior to the site visit a check list of documentation such as statutory licences, consents and permits should be reviewed by the lead auditor together with information regarding the nature of the site, number of employees, process undertaken, site location and history should be obtained to assist the lead auditor to target the audit's sampling activities.

At the beginning of the audit process, the lead auditor should review the organisation's documentation such as environmental policy statements, programmed records or manuals for meeting its HS&E management system requirements. In doing so, use should be made of all appropriate background information on the auditee's organisation, e.g. premises history, land use, parent company information, policy etc. If the documentation is judged to be inadequate to conduct the audit, the client should be informed. Additional resources should not be expended until further instructions have been received from the client. Until this documentation has been received and evaluated, it is not possible to determine the scope of the audit.

E.6.1.2 Audit scope

The audit scope describes the extent and boundaries of the audit in terms of factors such as physical location and organisational activities as well as the manner of reporting. The

scope of the audit is determined by the client and the lead auditor. The auditors should normally be consulted when determining the scope of the audit. Any subsequent changes to the audit scope require the agreement of the client and the lead auditor. The resources committed to the audit should be sufficient to meet its intended scope.

E.6.2 Preparing the audit

E.6.2.1 Audit plan

The audit plan should be designed to be flexible in order to permit changes in emphasis based on information gathered during the audit, and to permit effective use of resources. The plan should, if applicable, include:

a) The audit objectives and scope;
b) The audit criteria;
c) Identification of the auditee's organisational and functional units to be audited;
d) Identification of the functions and/or individuals within the auditee's organisation having significant direct responsibilities regarding the auditee HS&E management system;
e) Identification of those elements of the auditee's HS&E management system that are of high audit priority;
f) The procedures for auditing the auditee's HS&E management system elements as appropriate for the auditee's organisation;
g) The working and reporting languages of the audit;
h) Identification of reference documents;
i) The expected time and duration for major audit activities;
j) The schedule of meetings to be held with the auditee's management;
k) The dates and places where the audit is to be conducted;
l) Identification of audit-team members;
m) Confidentiality requirements;
n) Report content and format, expected date of issue and distribution of the audit report;

o) Document retention requirements of the auditors.

The audit plan should be communicated to the client, the audit-team members and the audited. The client should review and approve the plan.
If the auditee objects to any provisions in the audit plan, such objections should be made known to the lead auditor. They should be resolved between the lead auditor, the audit and the client before conducting the audit. Any revised audit plan should be agreed between the parties concerned before or during the audit.

E.6.2.2 Audit-team assignments

As appropriate, each audit-team member should be assigned HS&E management system elements, functions, or activities to audit and be instructed on the audit procedure to follow. Such assignments should be made by the lead auditor in consultation with the audit-team members concerned. During the audit, the lead auditor may make changes to the work assignments to ensure the optimal achievement of the audit objectives.

E.6.2.3 Working documents

The working documents required to facilitate the auditor's investigations may include:

a) Forms for documenting supporting audit evidence and audit findings;
b) Procedures and checklists such as that in appendix 2 used for evaluating HS&E management system elements;
c) Records of meetings.

Working documents should be maintained at least until completion of the audit. The audit-team members should suitably safeguard those involving confidential or proprietary information.

E.6.2.4 Coping with the unexpected

Auditors have to be able to recognise the limitations of their own abilities. Inevitably there will be occasions when auditors will be confronted by situations or issues that they

may not be competent to deal with, or that are outside their remit but which are recognised to be of serious concern. They need to ensure that any such matters are brought to the attention of the lead auditor so that they can receive appropriate action.

E.6.3 Conducting the audit

E.6.3.1 Opening meeting

There should be an opening meeting. The purpose of an opening meeting is to:

a) Introduce the members of the audit team to the auditee's management;
b) Review the scope, objectives and audit plan and agree on the audit timetable;
c) Provide a short summary of the methods and procedures to be used to conduct the audit;
d) Establish the official communication links between the audit team and the audit;
e) Confirm that the resources and facilities needed by the audit team are available;
f) Confirm the time and date of the closing meeting;
g) Promote the active participation by the audit;
h) Review relevant site safety and emergency procedures for the audit team.

E.6.3.2 Collecting audit evidence

Sufficient audit evidence should be collected to be able to determine whether the auditee's HS&E management system conforms to the HS&E management system audit criteria.

Audit evidence should be collected through interviews, examination of documents and observation of activities and conditions. Indications of non-conformity to the HS&E management system audit criteria should be recorded. There is always a danger of relying purely on paper evidence and emphasis must be given to the examination and observation of the standards of control within the activity being audited. To support these observations, it is important that the audit team are fully conversant with the current standards of control (both legal minimum and the best practice).

Information gathered through interviews should be verified by acquiring supporting information from independent sources, such as observations, records and results of existing measurements. Non-verifiable statements should be identified as such.

In addition it is important that the auditors distinguish between opinion and factual observation. There is a place for both within the audit, but it is important that the observations relating to opinion are made clear in the audit feedback/report.

The audit team should examine the basis of relevant sampling programmes and the procedures for ensuring effective quality control of sampling and measurement processes, used by the audit as part of its HS&E management system activities.

At the end of each audit day, it is recommended that the audit team meet to:

- Discuss individual findings;
- Identify the progress of the audit against the original timetable;
- Identify whether the scope of the audit is still adequate and relevant;
- Summarise the current audit findings for the lead auditor.

E.6.3.3 Audit findings

The audit team should review all of their audit evidence to determine where the HS&E management system does not conform to either the HS&E management system audit criteria or minimum legal standards. The audit team should then ensure that audit findings of non-conformity are documented in a clear, concise manner and supported by audit evidence.

Audit findings should be reviewed with the responsible audit manager with a view to obtaining acknowledgement of the factual basis and reasons why of all findings of major non-conformity.

E.6.3.4 Closing meeting

After completion of the audit evidence collection phase and prior to preparing an audit report, the audit team should hold a meeting with the auditee's management and those responsible for the functions audited. The main purpose of this meeting is to present

audit findings to the audit in such a manner as to obtain their clear understanding and acknowledgement of the factual basis of the audit findings.

Disagreements should be resolved, if possible, by constructive communications, before the lead auditor issues the report. Final decisions on the significance and description of the audit findings ultimately rest with the lead auditor, although the audit or client may still disagree with these findings.

E.6.4 Audit reports and document retention

E.6.4.1 Preparation of audit report

The audit report is prepared under the direction of the lead auditor, who is responsible for its accuracy and completeness. The topics to be addressed in the audit report should be those determined in the audit plan. The parties concerned should agree upon any changes desired at the time of preparation of the report.

E.6.4.2 Content of audit report

The audit report should be dated and signed by the lead auditor. It should contain a summary with recommendations, followed by the audit findings and detailed supporting evidence. Subject to agreement between the lead auditor and the client, the audit report should, where relevant, include the following:

a) The identification of the organisation audited and of the client;
b) The agreed objectives, scope and plan of the audit;
c) The agreed criteria, including a list of reference documents against which the audit was conducted;
d) The period covered by the audit and the date(s) the audit was conducted;
e) The identification of the auditee's representatives participating in the audit;
f) The identification of the audit team members;
g) A statement of the confidential nature of the contents;
h) The distribution list for the audit report;
i) A summary of the audit process including any obstacles encountered;

j) Photographs;

k) Audit conclusions such as:

- Standards of HS&E comply as a minimum to local legal requirements;
- Standards comply with the HS&E management system;
- Whether the system is properly implemented and maintained;
- Whether the internal management review process is able to ensure the continuing suitability and effectiveness of the HS&E management system;
- Where possible, suggested solutions;
- Priority scales;
- Positive findings;
- Comparisons of previous performance, where possible.

E.6.4.3 Distribution of the audit report

The lead auditor should send the audit report to the client. Distribution of the audit report should be determined by the client, in accordance with the audit plan. The auditors should receive a copy of the audit report unless specifically excluded by the client. Additional distribution of the report outside the auditee's organisation requires the auditee's permission. Audit reports are the sole property of the client, therefore confidentiality should be respected and appropriately safeguarded by the auditors and all report recipients.

The audit report should be issued within the agreed time period in accordance with the audit plan. If this is not possible, the reasons for the delay should be formally communicated to both the client and the audit and a revised issue date established.

E.6.4.4 Document retention

All working documents and draft and final reports pertaining to the audit should be retained by agreement between the client, the lead auditor and the audit and in accordance with any applicable requirements.

Chapter 6.0 Conclusions

6.1 The Need for Management Standards

Throughout the member states of the European Union the standards of both occupational health and safety and environmental control require further improvement to minimise the current levels of loss. Management systems are often seen as an effective means of reducing this loss by continuously improving standards. Whilst there is much discussion and debate about the possibilities of integrating management systems, at present, there are no nationally published integrated management standards, although some multi-national companies have introduced their own internal integrated standards.

This chapter presents the conclusions of this research and recommendations for further work. It is divided between a summary of work undertaken within this thesis, the contribution to knowledge from the current research and further works that could be undertaken in order to pursue further the novel ideas put forward by this research.

6.2 Summary of Work Done

The work undertaken by this thesis consisted initially of analysing all relevant literature. This included the analysis of the issues surrounding management systems, such as what systems are currently used, what developments of these systems are planned and the legal framework within which these systems operate.

To determine the practical and tangible benefits or otherwise of management systems, health, safety and/or environmental audits were conducted. The results and statistical analysis supports the hypothesis that organisations with formalised health, safety and environmental management standards are more likely to achieve higher standards of physical control than those with no or informal management standards.

As a result of previous research, an initial framework for an integrated health, safety and environmental management standard had already been developed. This research established that organisations were in favour of the concept of such an integrated management system. Further analysis determined that, as a first stage, the integration of health, safety and the environment was the preferred option rather than integration of health, safety, environment and quality. The reason for this was that health and safety and environmental standards can usually be referenced against detailed, often legal standards and enforcement, as opposed to quality systems, which are based on customer satisfaction. Additionally, the means of assessment and control of potential health, safety and environmental issues are often the same and therefore the technical means of control need to be considered together.

The developed integrated health, safety and the environmental management standard framework, however, contained little detail of the means of implementation, such as methodologies for significance review, risk assessment, and audit, together with appendices for policies, communications, training, and measurement. These were developed as part of the integrated standard and tested. The conclusions of this research are detailed below.

6.2.1 Initial Significance Review

The advantages of the initial significance review were the ability to identify key potential non-conformances, prior to the introduction of management system. The initial significance review could also be used as a "weighting" factor to develop risk assessment and audit priorities and may have greater uses for such potentials as liability surveys.

The disadvantages of the initial significance review was that the significance of each health, safety and environmental topic tended to vary between organisations e.g. environmental air emissions to a chemical plant are critical, however, to a printing company air emissions are of little consequence. As a result one uniform transferable initial significance review method could not be developed.

The overall weighting factor developed, as part of the integrated significance review, was sensitive to each of the three component factors of severity, standards of physical control and business risk, particularly the severity factor. Any errors in allocating the correct category had a significant effect upon the overall weighting score, making the methodology less robust than would be desired. Whilst this was acknowledged as a weakness, it was not considered to be a fundamental flaw in the technique itself.

6.2.2 Integrated Risk Assessment

It was possible and desirable to integrate environmental and health and safety risk assessment into one single method, however, this method was not fully integrated. The reason for this was that health and safety is a task-based function whereas environmental risk assessment tends to examine the global situation. A partially integrated risk assessment model was developed, which separated the health and safety components from the environmental components. This model retained some common elements, particularly with the outcomes of the assessment process, and has a similar 'look and feel' and management approach to all elements.

It was necessary to establish a mechanism to assist in prioritising the outcomes of the integrated assessment process, so that the relative importance of the remedial actions noted can be established. The outcome of the significance review can be used for this purpose.

The assessment enabled organisations to distinguish between the normal operating conditions, shut down and start up conditions, as well reasonably foreseeable or emergency situations.

The judgement as to whether control of a particular health, safety or environmental hazard has been achieved can only be against a comparison against standards. These standards in turn can be legal, company or best practice. However, direct comparisons need to be made by the assessors in determining the adequacy of the assessment. If this is not achieved there is a danger that, because the assessors lack the detailed technical knowledge of that issue, they make judgements on the side of caution. It was perceived by the auditors that it better to over-estimate rather than under-estimate the scale of the risk which could potentially lead to loss and possibly criticism of themselves.

The outcomes of the risk assessment process are considered to be the critical issue. These need to be managed with regard to the potential losses, legal compliance, stakeholder interests and costs of remedial action. If the management decisions are based upon poor quality information and erroneous judgements then this will produce inappropriate targets, leading to ineffective control, wasted resources and potentially increased risks.

6.2.3 Audit

Whilst it was possible, it was not desirable to integrate environmental and health and safety audits because it is not practical for the audit to be conducted by a non-professionally qualified person. Without the specialist technical knowledge, the pro-forma question does not allow an examination of the physical standards other than at a top systems level one.

It would be possible to design a series of questions which would examine the physical performance of a particular topic against the standard. It is considered that these questions would be very detailed indeed and only relevant to the site being audited. For these reasons, it is considered that advantages of such a system would be disproportionate, bearing in mind the cost of producing such a detailed audit questionnaire for each individual site. The audit methodology result would also not be transferable across different organisations or sites and therefore could not be standardised.

If professionally qualified staffs are used for the audit, then it was not be necessary to develop a detailed pro-forma questionnaire, as their professional knowledge would permit questioning of the compliance to this standard as part of the audit process. In addition they would examine and test the first element of the audit purpose, the validity of the standard being audited.

Where topics were not covered by audit pro-forma questionnaire, for example ergonomics or loss of containment, then the auditee will not be able to identify a significant risk as he or she will be working within the constraints of the audit pro-forma. This may mean a significant health, safety or environmental risk may be ignored through lack of technical competence and over reliance on the value of an audit pro-forma.

The audit pro-forma is technically reliable. However, the original aim of developing a system for non-safety, health and environmentally experienced staff to use, has proven not be practical and of limited benefit.

6.2.4 Integrated Management Standard

The research identified that the effectiveness of the management standard was variable, depending upon the level of use.

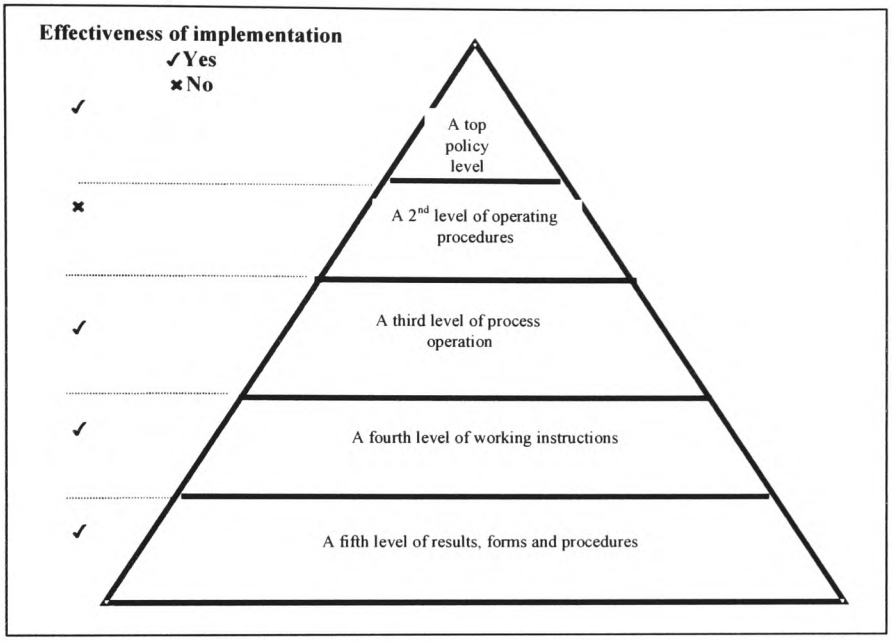


Figure 6- 1 The Advantages and Disadvantages of Implementing the Integrated Standard.

At most levels of implementation, the integrated standard was effective. However, the integrated risk assessment and audit methodologies proved to be the least effective, particularly when used by non-specialist personnel.

The research concluded that for many organisations, the introduction of the integrated health safety and environmental management standard did bring tangible benefits. However, at certain levels, the separate health and safety or environmental management standards were equally as effective. Organisations can choose between running separate parallel management systems with a similar 'look and feel' or integrating, particularly at the framework policy level and levels four and five, the working level.

The integrated standard is most effective with large complex multi-hazard industrial organisations. The integrated standard is less beneficial for other types of organisation particularly when the degree of risk posed by their operations to either the health and safety of individuals or to the environment is low, for example, large retail organisations. For these organisations the costs of introduction would be disproportionate to the benefits in the introduction of such an integrated standard.

For suitable organisations that already had introduced formalised management systems, there were clear measurable benefits as the physical standards of control of the potential health, safety and/or environmental risks were demonstrated to be good.

6.2.5 European Requirements

The integrated standard complies with both European National Standards and legal requirements, and therefore could be used within any of the member states.

6.3 Contribution to Knowledge

This research has developed the concepts of integration which have been widely discussed, but not developed into a workable detailed standard and appendices implemented in practice. The testing of this integrated standard identified the following advantages and disadvantages:

Advantages

- The feasability of integrating health, safety and environment in a management system;
- The clear measurable benefits of formalised management systems in controlling risk;
- The potential to develop the initial significance review as a risk underwriting mechanism for organisation's such as insurance companies etc;
- The reduction in costs by minimising duplication of resourses;
- The ability to target resourses more effectively;
- Benefits in public perception and image;
- Compliance with legal requirements and standards.

Disadvantages

- Limitations of the integrated audit;
- The sensitivity of the significance review mechanism to error;
- Limitations of the integrated risk assessment;
- The degree of competence required by the assessors and auditors;
- The extent of integration possible;
- The limitation to large complex multi-hazard industrial organisations. As for other organisations, the costs of introduction would be disproportionate to the benefits.

This research identified a correlation between the presence of a management standard and high standards of physical control of health, safety and/or environment. This has often been assumed but there has been limited research to support this view.

This standard can also contribute to the proposed development of future European and International occupational health and safety management standards.

6.4 Recommendations for Further Work

The author recommends that further work should be established in order to develop this integrated standard further:

- Developing the initial significant review as a risk underwriting mechanism for organisation's such as insurance companies etc.
- Fully implement the integrated management standard within an organisation and compare its success or otherwise against separate health and safety and environmental scheme accreditation's such as ISO 14000;
- Participate in the development of a European occupational health and safety management standard in conjunction with the European Agency for Safety and Health at Work forthcoming project;
- Consider further integrating quality, health and safety and environment beyond a top tier policy level with integrated tools that will effectively include quality standards as well;
- Examine further the feasibility of integrating level two risk assessment and audit mechanisms for the non-specialist.

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Appendices

Appendix 1: Standard Setting Bodies

The Development of National and International Standards

Background

Towards the end of the 19th Century the engineering sector faced a growing problem as a result of a lack of standardisation in a number of areas e.g. building materials and in particular, steel girders. The cost of producing and stocking different sized girders was having a dramatic effect on the economic health of the sector.

To address the problems of lack of standardisation, each country developed national bodies to develop national standards. By the 1920's with the beginnings of a global trading economy, the need for international standards became apparent as each separate country found their products not complying with another's national standards and therefore proving to be a barrier to trade. Following a meeting in London in 1946, delegates from 25 countries decided to create a new international organization its purpose was to facilitate the international coordination and unification of industrial standards.

The new organization, International Standards Organisation (ISO) began to function officially on 23 February 1947.

Each of the National, European and International standards bodies will have an influence on the development and promulgation of a particular standard. The main standards bodies relevant to the development of quality, health and safety and environmental management standards are detailed below.

The British Standards Institution (BSI)

History

The origins of BSI can be traced to a committee set up with two representatives from each of four professional bodies namely the Institutions of Mechanical Engineers, Naval Architects and the Iron and Steel Institute. This committee which was called the Engineering Standards Committee and first met on 26 April 1901. By 1902 the Institute of Electrical Engineers had also joined. These five professional institutions are enshrined in the written Constitution of BSI and are referred to as the `Founder Institutions`.

The main Committee appointed subordinate sectional committees (predecessors of the current technical committees), which drew up specifications on receipt of requests from industry. The first specifications that the committees prepared were for steel sections for bridges, rolling stock underframes, ship building and rail. In May 1902, the Rt Hon Arthur Balfour MP, who was shortly to become Prime Minister, agreed to Government financial support for the Committee for the application of standards to the requirements of all the Departments of State. In 1918 the Committee changed its name to the British Engineering Standards Association and in 1929 it was granted a Royal Charter. The final name change took place in 1931 when it was agreed to adopt the name British Standards Institution.

Purpose

BSI is a privately funded institution constituted under a Royal Charter. It is the Standards Development Division, which has the remit to enhance UK business competitiveness and consumer satisfaction by promoting and facilitating voluntary consensus standards and conformity assessment systems. Whenever BSI participates on an ISO TC, it acts on behalf of the affected UK interests. BSI does not itself write standards, but rather serves as a facilitator for the development of national consensus standards, establishing, promulgating and administering procedures and criteria for their recognition and approval. Further, BSI is the UK member of the following two key international standards bodies and the two equivalent European standards bodies:

- International Organisation for Standardisation (ISO);
- International Electrotechnical Commission (IEC);
- European Committee for Standardisation (CEN);
- European Committee for Electrotechnical Standardisation (CENELEC).

Comité Européen de Normalisation (CEN)

History

The majority of the current National Members of CEN founded the association in 1961. It was first based in Paris under the aegis of AFNOR (the National Member for France). In 1975, CEN moved to Brussels, acquired formal Statutes and was registered as a non profit-making, international, and scientific and technical institution. It is therefore an independent organisation.

Purpose

CEN's mission is to promote voluntary technical harmonization in Europe in conjunction with worldwide bodies and its partners in Europe. Harmonization diminishes trade barriers, promotes safety, allows inter-operability of products, systems and services, and promotes common technical understanding. CEN is responsible for European standardisation in all fields except Electrotechnical (CENELEC) and Telecommunications (ETSI). Table A-1 specifies both the current full and affiliate member countries represented. CEN is the European representative on the following two key international standards bodies:

- International Organisation for Standardisation (ISO);
- International Electrotechnical Commission (IEC).

Table A-1 Membership of Comité Européen de Normalisation

Full Members of CEN				
Organisation	Country		Organisation	Country
ÖNORM	Austria		UNI	Italy
IBN/BNI	Belgium		ITM	Luxembourg
DS	Denmark		NNI,	Netherlands
SFS	Finland		NSF	Norway
AFNOR	France		IPQ	Portugal
ELOT	Greece		AENOR	Spain
STRI	Iceland		SIS	Sweden
NSAI	Ireland		SNV	Switzerland
DIN	Germany		BSI.	United Kingdom
Affiliate Members of CEN				
Organisation	Country		Organisation	Country
CSM	Bulgaria		PKN	Poland
CYS	Cyprus		IRS	Romania
COMST	Czech Republic		UNMS	Slovakia
EVS	Estonia		SMIS	Slovenia
MSZH	Hungary		TSE	Turkey
LST	Lithuania			

The American National Standards Institute (ANSI)

History

Founded in 1918 by five engineering societies and three government agencies, the American National Standards Institute (ANSI) remains a private, non-profit membership organisation.

Purpose

ANSI does not itself develop American National Standards (ANSs); rather it facilitates development by establishing consensus among qualified groups. ANSI promotes the use of U.S. standards internationally, advocates U.S. policy and technical positions in international and regional standards organisation's, and encourages the adoption of International Standards as National Standards where these meet the needs of the user community. ANSI is the sole U.S. representative and fee-paying member of ISO. ANSI was a founding member of the ISO and is one of five permanent members to the governing ISO Council, and one of four permanent members of ISO's Technical Management Board.

The International Standards Organisation (ISO)

History

International standardisation began in the electrotechnical field: the International Electrotechnical Commission (IEC) was created in 1906. The International Federation of the National Standardizing Associations (ISA), which was set up in 1926, carried out pioneering work in other fields. The emphasis within ISA was laid heavily on mechanical engineering. ISA's activities ceased in 1942, owing to the Second World War. Following a meeting in London in 1946, delegates from 25 countries decided to create a new international organization "the object of which would be to facilitate the international coordination and unification of industrial standards". The new organization, ISO, began to function officially on 23 February 1947. The first ISO standard was published in 1951 with the title, "Standard reference temperature for industrial length measurement".

Purpose

ISO is a worldwide federation of national standards bodies, comprising some 110 members, one for each country. The object of ISO is to promote the development of standardisation and related activities world-wide with a view to facilitating international exchange of goods and services, and to develop co-operation in the spheres of intellectual, scientific, technological and economic activity. Results of ISO technical works are published as International Standards.

The Structure of ISO

The technical work of ISO is managed by a policy level management board called the Technical Management Board (TMB) of which BSI is a member. The actual technical work is carried out through Technical Committees (TC).

A proposal to begin work in a new field of technical activity, such as Occupational Health and Safety Management Standard (OHSMS) normally comes from within ISO itself. Within Europe CEN/CENELEC may be mandated to develop standards by the EU Commission. All new proposals are ultimately submitted to the ISO member bodies for consideration. If accepted, either the new work will be referred to the appropriate existing technical committee or a new TC will be established. The decision to establish a TC is taken by the TMB, which also approves its scope. Within the scope, the TC determines its own programming of work.

At its first meeting, the TC reviews its scope and decides on an initial structure and program of work. The TC may establish sub-committees (SC) and Working Groups (WG) to cover different aspects of its work. Each subcommittee formed is assigned a scope, which must be within the scope of the TC. A national body is assigned the Secretariat. In case of WGs, a convenor is appointed for each. The draft standard will be developed by the TC, then the TMB will decide after a full vote of member organisations, whether to formally adopt and publish the standard.

As world trade becomes ever more globalised, the importance of International standards cannot be understated. Market forces for the introduction of International standards is greater than ever, as organisations and countries seek a 'level playing field'. For example, the introduction of ISO 9000 quality Management Standard and ISO 14,000 Environmental Management Standard has considerably increased pressures on organisations to development and certified to these standards, sometimes as a pre-requisite to trade.

Appendix 2: European Organisations

Appendix 2: European Organisations

Introduction

Any European national member state is constrained in the introduction of both health and safety or environmental legislation by the primacy of the European Union Directives and Legislation, as a result of that member states commitment to the Treaty of Rome. Appendix two details the various European bodies that influence the development of both European wide legislation and the promotion of market force initiatives such as voluntary management standards.

European Commission

The European Commission comprises of 20 male and female staff who are its Members and the 15,000 staff it employs directly.

Commission organisation

The Commission is divided into 26 Directorates-General (DGs) with additional fifteen specialized services. Each DG is headed by a Director-General, reporting to a Commissioner who has the political and operational responsibility for the work of the Directorates-General.

The work of the Commission

The Commission's role identifies three distinct functions:

Legislative initiative

The legislative process begins with a Commission proposal, Community law cannot be made without one. In devising its proposals, the Commission has three constant objectives:

1. To identify the European interest;
2. To consult as widely as is necessary; and
3. To respect the principle of subsidiarity.

Subsidiarity

This is enshrined in the Treaty on European Union and is applied by the Commission in such a way as to ensure that the Union takes action only when it will be more effective than if left to individual Member States.

Guardian of the Treaties

It is the Commission's role to ensure that Union legislation is applied correctly by the Member States. If they breach their Treaty obligation, they will face Commission action, including legal proceedings at the Court of Justice. In certain circumstances, the Commission can fine individuals, firms and organisations for infringing Treaty law, subject to their right to appeal to the Court of Justice.

The Commission Members

The Heads of State or Governments after consulting the European Parliament then chooses the President. The 15 member governments in consultation with the incoming President nominate the other members of the Commission. The Commission meets once a week to conduct its business. Commissioners are expected to give full support to all policies, even when a majority adopts them. The current European commissioners are detailed in the Table below.

Table A-2 Current Commission Members (as of May 2000)

Commissioner	Responsibility
Romano Prodi	President
Neil Kinnock	Vice-president Administrative Reform
Loyola de Palacio	Vice-president Relations with the European Parliament, Transport & Energy
Mario Monti	Competition
Franz Fischler	Agriculture, Rural Development & Fisheries
Erkki Liikanen	Enterprise & Information Society
Frits Bolkestein	Internal Market
Philippe Busquin	Research
Pedro Solbes Mira	Economic & Monetary Affairs
Poul Nielson	Development & Humanitarian Aid
Günter Verheugen	Enlargement
Chris Patten	External Relations
Pascal Lamy	Trade
David Byrne	Health & Consumer Protection
Michel Barnier	Regional Policy
Viviane Reding	Education & Culture
Michaele Schreyer	Budget
Margot Wallström	Environment
Antonio Vitorino	Justice & Home Affairs
Anna Diamantopoulou	Employment & Social Affairs

Commission Organisation for Health and Safety

The Commissioner for Employment and Social Affaires is Anna Diamantopoulou. The Commission is formally supported by a committee known as the Advisory Committee on Safety, Hygiene and Health Protection at Work. The main objective of this Committee is to assist the Commission in the preparation and implementation of activities in the field of health and safety at work and facilitating co-operation between national administrations, trade unions and employers' organisation's. It consists of 90 full members, i.e. two government representatives, two trade union representatives and two representatives of employers per Member State, appointed by the Council for a period of three years (renewable). A Member of the Commission chairs the Committee and the opinions of the Committee are delivered by an absolute majority of the valid votes and must state the reasons on which they are based.

The permanent commission staffs provide the executive support this advisory committee. Areas of Activity of the Advisory Committee on Safety, Hygiene and Health Protection at Work include:

- Safety
- Health
- Psychosocial & Ergonomic Factors
- Chemical, Physical & Biological agents

The Directorate General for Employment and Social Affairs is based in Brussels and Luxembourg. It is made up of seven Directorates, six responsible for different areas of social policy and one dealing with resource management. The Directorates are sub-divided into units, with further administrative units reporting directly to the Director-General. The current Director-General for Employment and Social Affairs is Mr. Ron Coleman.

Directorate D is responsible for social dialogue, social rights and equality issues. The responsibility for occupational safety and health is within the Sub Directorate D6. This Sub Directorate is headed by Jose Ramon Biosca de Sagastuy and has the responsibility

for health safety and hygiene at work. Included in the areas of activity for this sub directorate D6 is policy responsibility for health and safety management.

The legal basic for the work of this Directorate revolves around Article 118a of the Treaty of Rome, which provides both the legal basis and sets out a general principle:

> 'Member States shall pay particular attention to encouraging improvements, especially in the working environment, as regards the health and safety of workers, and shall set as their objective the harmonisation of conditions in this area, while maintaining the improvements made'.

European Agency for Safety and Health at Work.

The Council Regulation Number 2062/94 established a European Agency for Health and Safety at Work. (O.J. 1994). The Agencies purpose is to serve the information needs of people with an interest in occupational safety and health.

The Agency is managed by a Director and has an Administrative Board, which is made up of representatives of government, employers and workers from the fifteen Member States and three representatives of the European Commission. Located in Bilbao (Spain) the Agency co-ordinates since 1997 a network with a focal point in each Member State of the Union.

The European Agency's objective, as set out in the founding Regulation:

> "In order to encourage improvements, especially in the working environment, as regards the protection of the safety and health of workers as provided for in the Treaty and successive action programmes concerning health and safety at the workplace, the aim of the Agency shall be to provide the Community bodies, the Member States and those involved in the field with the technical, scientific and economic information of use in the field of safety and health at work." (O.J. 1994)

Within this information gathering capacity the agency undertakes surveys of member states views as to occupational health and safety.

Commission Organisation for the Environment

Responsibility for the environment is that of the Directorate General XI. The current Director-General of Environment is Mr James Currie. The Directorate is divided up into a number of Sub Directorates, namely:

Directorate A: General and International Affairs
Directorate B: Integration Policy and Environmental Instruments
Directorate C: Nuclear Safety and Civil Protection
Directorate D: Environment Quality and Natural Resources
Directorate E: Industry and Environment

The responsibility for Environmental Management is within Directorate E4. This Sub Directorate is headed by Herr Klaus Krisor and has the responsibility for industry, internal market, products and voluntary approaches, Environmental management and Eco-audit.

The European Environment Agency

The European Union founded the European Environment Agency (EEA) in 1993 with a mandate to orchestrate, crosscheck and put to strategic use information of relevance to the protection and improvement of Europe's environment. This is reflected in the EEA's mission statement, which is:

'To support sustainable development and to help achieve significant and measurable improvement in Europe's environment through the provision of timely, targeted, relevant and reliable information to policy making agents and the public'. (EEA.1998)

The European Environment Agency is based in Copenhagen, Denmark, and has a mandate defined by Council Regulation (EEC) No. 1210/90:

'To ensure the supply of objective, reliable and comprehensive information at European level, enabling its member states to take the requisite measures to protect their

environment, to assess the result of such measures and to ensure that the public is properly informed about the state of the environment'.

The geographical scope of the Agency's work is not confined to Member States of the EU; membership is open to other countries that share the concerns of the EU and member states and the objectives of the Agency. Current membership includes all 15 EU states, as well as Iceland, Liechtenstein and Norway.

Appendix 3 Audit Pro Forma

Appendix 3 Health, Safety and Environmental Audit Questionnaire

Environmental, Health and Safety Audit

Company	
Location	
Department	
Date Last Audited	
Date of Audit	
Audit Team Members	

Previous Audit Score	
Current Audit Score	

PART A: MANAGEMENT STANDARDS

Element Number	Question	Score				
		1	3	5	N/a	Comment
		No/Never/None	Some/50%/so metimes	Yes/Always/ All		
4.0.1 General	1. Is there an established and maintained an EHS management system.					
4.0.2 Policy	2. Has an initial review been carried out?					
4.1 Policy						
4.1 EHS policy	3. Is the current EHS Policy up-to-date?					
	4. Are individual responsibilities clearly set out?					
	5. Does the organisational section of this policy specific the detailed arrangements for the control of specific risks?					
	6. Is there a commitment of the necessary resources required within the Policy?					
	7. Are employees aware of the Policy?					
	8. Has the organisation's most senior management signed the EHS policy?					
	9. define the allocation of responsibilities and accountabilities in the management structure;					
	10. ensure people have the necessary authority to carry out their responsibilities;					
	11. allocate adequate resources commensurate with its size and nature:					
Number of Not applicable questions						
Column Total						
Overall score						

Element Number	Question	Score				
		1	3	5	N/a	Comment
		No/Never/None	Some/50%/so metimes	Yes/Always/All		
4.2 Planning						
4.2 Planning	Does the plan identify EHS requirements, setting clear performance criteria defining					
	12. what is to be done,					
	13. who is responsible,					
	14. when it is to be done					
	15. What is the desired outcome					
4.2.1 Risk assessment	The organisation should carry out risk assessment including identification of hazards					
2.2 Legal and other requirements	Has the organisation identified					
	16. the legal requirements, in addition to the risk assessment, applicable to it					
	17. Any relevant standards such as Environmental Agency, HSE BSI CEN Publications					
	18. What is the quality of the judgements of these assessments?					
	19. Has the remedial actions identified been incorporated into the EHS plan?					
Number of Not applicable questions						
Column Total						
Overall score						

Element Number	Question	Score				
		1	3	5	N/a	Comment
		No/Never/None	Some/50%/so metimes	Yes/Always/All		
4.2.3 EHS management arrangements	Has the organisation should make arrangements to cover the following key areas:					
	20. overall plans and objectives,					
	21. Designation of responsibility for achieving objectives and targets.					
	22. The means and time frame by which they are to be achieved.					
	23. have access to sufficient Health, safety and environmental knowledge, skills					
	24. planning for operational control activities					
	25. planning for performance measurement,					
	26. corrective action,					
	27. audits and management reviews					
	28. System for implementing any corrective actions shown to be necessary.					
Number of Not applicable questions						
Column Total						
Overall score						

Element Number	Question	Score				
		1	3	5	N/a	Comment
4.3 Implementation and Control		No/Never/None	Some/50%/so metimes	Yes/Always/All		
4.3 Implementation and operation	Are people at all levels of the organisation,					
	29. responsible for EHS of those they manage, themselves and others with whom they work;					
	30. aware of their responsibility for the EHS for contractors members of the public;					
	31. Aware of the influence that their action or inaction can have on the effectiveness of the EHS management system.					
4 3 2 Training. awareness and competence	32. Is there arrangements to identify the competencies required, and organise any necessary training.					
	33. Communication of health, safety and environmental information;					
	34. Is there the provision of specialist advice and services;					
	35. Is there employee involvement and consultation?					
	36. Is there internal communication between the various levels of the organisation;					
	37. Are people aware of documentation and responding to relevant communication from external interested parties					
Number of Not applicable questions						
Column Total						
Overall score						

Element Number	Question	Score				
		1	3	5	N/a	Comment
		No/Never/None	Some/50%/so metimes	Yes/Always/All		
4.3 5 Document control	38. Is there arrangements to ensure that documents are up to date and relevant					
	39. Is there arrangements to externally communication its significant EHS aspects					
3 6 Operational control	40. Is there documented procedures to cover situations where their absence could lead to deviations from the policy , objectives and targets;					
	41. Is there documentation stipulating operating criteria in the procedures;					
	42. Is there procedures related to the identifiable significant EHS aspects of goods and services used by the organisation.					
	43. Is there procedures for communicating relevant procedures and requirements to suppliers and contractors					
	44. Is there documented Safe Operating Procedures					
	45. Is there documented Permits to work					
Emergency preparedness and response	46. Are their arrangements for contingency plans for foreseeable emergencies and to mitigate their effects?					
Number of Not applicable questions						
Column Total						
Overall score						

Element Number	Question	Score				
		1	3	5	N/a	Comment
4.4 Checking and corrective action		No/Never/None	Some/50%/sometimes	Yes/Always/All		
4 4 2 Corrective action	47. Where deficiencies are found, are the root causes identified and corrective action taken.					
	48. Are there documented records any changes in the documented procedures resulting from corrective and preventive action?					
4 4 3 Records	49. Are there records to demonstrate compliance with legal and other requirements?					
4.4 Audit	50. Is there a programme for externally verified third party audits of all the elements of the health, safety and environmental management system?					
4.5 Management review	51. Is there a periodic review of the EHS management system? These reviews should consider					
4.5 Management review	52. the overall performance of the EHS management system;					
	53. the performance of individual elements of the system;					
	54. the findings of audits;					
	55. internal and external factors, such as changes in organisational structure, legislation pending, the introduction of new technology, etc.,					
	56. Identify what action is necessary to remedy any deficiencies.					
Number of Not applicable questions						
Column Total						
Overall score						
Total Score Part A: MANAGEMENT STANDARDS						

TOTALS AUDIT ELEMENT A

Element	Score	Number of n/a	B × 5	Adjusted Score	Total Number of questions	Maximum score	$\frac{D}{F} \times 100$
	A	B	C	D	E	F	G
4.0 to 4.1					**11**	**55**	
4.2					**17**	**85**	
4.3					**17**	**85**	
4.4					**4**	**20**	
4.5					**6**	**30**	
						$\Sigma = 275$	Σ
Total A = $\frac{\Sigma H}{5}$			**Total A =**				

PART B: SPECIFIC TOPIC QUESTIONS

Control of Contractors

Part A Volume		Score
No Contractors used		1
Occasional use of contractors		
Extensive use of contractors		2

Part B Significance Factor

Severity of Outcome (S)		*Degree of Control (C)*		*Business Risk (BR)*	
Minor injury, short term ill health, minor environmental impact	1	Best Practice standards	1	Limited impact if worst case scenario	1
Major injury ill health causing loss of at least 1 week, damage to species such as fish poisoning	2	Meeting legal compliance with full management and documentation.	2	Limited effects, no production loss, limited local publicity	2
Death/permanent ill-health or significant species damage	3	Meeting legal compliance with limited documentation or systems	3	Short term loss (loss of weeks) Enforcement Notice	3
		Below legal compliance	4	Death, damage to production and/or major environmental impact causing adverse publicity and fine	4
				Multiple death, significant damage to production causing possible permanent loss and/or major environmental impact causing significant adverse publicity	5
Severity of Outcome (S)		**Degree of Control (C)**		**Business Risk (BR)**	
Part B Significance Factor (S) × (C) × (BR) =					

Part C Score = Part A Volume × Part B Significance Factor

	Part A Score	**Part B Score**
Total		
	1-40	**41-80**	**81- 120**
Overall Significance Factor	**Low**	**Medium**	**High**

Contractors					
Questions (Score)	1	3	5	N/A	Comments
	No/Never/ None	Some/50%/s ometimes	Yes/Always/ All		
1. Are contractors required to complete a health and safety competence questionnaire at the tendering stage?					
2. When appropriate is the contractor required to furnish evidence of professional qualifications, membership of Associations etc.?					
3. Are contractors required to submit a risk assessment and safety plan/method statement before they commence work?					
4. Is a company Risk Assessment of contractors activities carried out before work commences					
5. Is a person nominated to control contractors activities whilst working on the premises?					
6. Does the contractor sign the "Contractors Safety Information Sheet" before work commences?					
7. Does our "nominated persons" frequently monitor contractors activities on site?					
8. Is there a system in place to ensure that managers are aware of any contractors an in their area?					
9. Is there a review of any accidents/near miss circumstances involving contractors					
10. Is there an "approved list" of contractors					
Answer Total					
Number of not applicable questions ticked					

Fire

Part A Volume		Score
Few people employed on ground floor only		1
Multi story building		
Factory process		2
Process involving the use of HFL's		

Part B Significance Factor

Severity of Outcome (S)		*Degree of Control (C)*		*Business Risk (BR)*	
Minor injury, short term ill health, minor environmental impact	1	Best Practice standards	1	Limited impact if worst case scenario	1
Major injury ill health causing loss of at least 1 week, damage to species such as fish poisoning	2	Meeting legal compliance with full management and documentation.	2	Limited effects, no production loss, limited local publicity	2
Death/permanent ill-health or significant species damage	3	Meeting legal compliance with limited documentation or systems	3	Short term loss (loss of weeks) Enforcement Notice	3
		Below legal compliance	4	Death, damage to production and/or major environmental impact causing adverse publicity and fine	4
				Multiple death, significant damage to production causing possible permanent loss and/or major environmental impact causing significant adverse publicity	5
Severity of Outcome (S)		**Degree of Control (C)**		**Business Risk (BR)**	

Part B Significance Factor (S) × (C) × (BR) =

Part C Score = Part A Volume × Part B Significance Factor

	Part A Score	**Part B Score**
Total		
	1-40	**41-80**	**81- 120**
Overall Significance Factor	**Low**	**Medium**	**High**

Criteria FIRE					
Questions (Score)	1	3	5	N/A	Comments
	No/Never/None	Some/50%/sometimes	Yes/Always/All		
1. Are these procedures posted up at various locations?					
2. Have fire wardens been appointed and trained?					
3. Is the fire alarm (and emergency lighting where provided) subject to regular maintenance?					
4. Is access to the fire extinguishers free and clear?					
5. Are all fire exits clear and free from obstructions?					
6. Are fire extinguishers examined at least every 12 months?					
7. Are corridors and stairwells free of combustible material?					
8. Are fire check doors kept closed?					
9. Is fire awareness training provided to EMPLOYEES					
10. Is the fire alarm tested weekly from a different call point on each occasion?					
11. Is a fire drill held at least annually					
12. Are employees instructed in emergency procedures at least annually?					
13. Has a fire occurred since the previous audit?	Yes	Minor	No		
14. Are the above drills/tests/maintenance recorded in a logbook?					
Answer Total					
Number of not applicable questions ticked					

Housekeeping

Part A Volume		Score
Any Premises		1
Premises in Industrial setting		
Premises in a residential setting		2
Premises in a SSI setting		

Part B Significance Factor

Severity of Outcome (S)		*Degree of Control (C)*		*Business Risk (BR)*	
Minor injury, short term ill health, minor environmental impact	1	Best Practice standards	1	Limited impact if worst case scenario	1
Major injury ill health causing loss of at least 1 week, damage to species such as fish poisoning	2	Meeting legal compliance with full management and documentation.	2	Limited effects, no production loss, limited local publicity	2
Death/permanent ill-health or significant species damage	3	Meeting legal compliance with limited documentation or systems	3	Short term loss (loss of weeks) Enforcement Notice	3
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				Multiple death, significant damage to production causing possible permanent loss and/or major environmental impact causing significant adverse publicity	5
Severity of Outcome (S)		**Degree of Control (C)**		**Business Risk (BR)**	
Part B Significance Factor (S) × (C) × (BR) =					

Part C Score = Part A Volume × Part B Significance Factor

	Part A Score	**Part B Score**
Total		

	1-40	**41-80**	**81- 120**
Overall Significance Factor	**Low**	**Medium**	**High**

Criteria HOUSEKEEPING					
Questions (Score)	1	3	5	N/A	Comments
	No/Never/None	Some/50%/sometimes	Yes/Always/All		
External					
1. Is the area free of litter?					
2. Are entrance signs clean and visible?					
3. Are fences and gates in good repair?					
4. Is all waste (scrap, rubbish etc.) stored in a designated area or skip?					
5. Is the visual image of the site acceptable?					
6. Are the offices and buildings in a good state of repair, including paintwork?					
7. Is the site clear of weeds and untidy vegetation?					
Internal					
8. Are there sufficient waste disposal points all types?					
9. Is the space available for individual departments sufficient?					
10. Is there enough storage capacity for raw materials, in production, finished product etc.?					
11. Are general standards of housekeeping satisfactory: _					
12. Are local departmental toilets/washing facilities in a clean condition?					
13. Are there facilities for storage of work clothing where required?					
14. Are there a sufficient number of toilets/washing facilities for the number of staff?					
15. Are non-smokers protected from passive smoking in rest areas?					
16. Is the space provided for individual people and tasks sufficient? _					
17. Are there facilities close to toilets for pregnant women to lie down in rest periods?6					
Answer Total					
Number of not applicable questions ticked					

Machinery Safety

Part A Volume		Score
Limited mechanised processes		1
mechanised processes requiring little operator access e.g. small printing press		
Significant mechanised processes requiring little operator access e.g. robot cell		2
Significant mechanised processes requiring regular operator access e.g. power press		

Part B Significance Factor

Severity of Outcome (S)		*Degree of Control (C)*		*Business Risk (BR)*	
Minor injury, short term ill health, minor environmental impact	1	Best Practice standards	1	Limited impact if worst case scenario	1
Major injury ill health causing loss of at least 1 week, damage to species such as fish poisoning	2	Meeting legal compliance with full management and documentation.	2	Limited effects, no production loss, limited local publicity	2
Death/permanent ill-health or significant species damage	3	Meeting legal compliance with limited documentation or systems	3	Short term loss (loss of weeks) Enforcement Notice	3
		Below legal compliance	4	Death, damage to production and/or major environmental impact causing adverse publicity and fine	4
				Multiple death, significant damage to production causing possible permanent loss and/or major environmental impact causing significant adverse publicity	5
Severity of Outcome (S)		**Degree of Control (C)**		**Business Risk (BR)**	

Part B Significance Factor (S) × (C) × (BR) =

Part C Score = Part A Volume × Part B Significance Factor

	Part A Score	**Part B Score**
Total		
	1-40	**41-80**	**81- 120**
Overall Significance Factor	**Low**	**Medium**	**High**

Criteria MACHINERY SAFETY					
Questions (Score)	1	3	5	N/A	Comments
	No/Never/None	Some/50%/sometimes	Yes/Always/All		
1. Have risk assessments been carried out on all items of machinery in the area and have they considered the adequacy of guarding of dangerous parts?					
2. Has action been taken on all recommendations (or is a programme of work in hand)?					
3. Are all guards provided in place and in good condition and are interlock systerns/trip guards in good working order?					
4. Are guards of sufficient size, location and extent to cover access to dangerous parts from all directions?					
5. Are openings or gaps in guards (for infeed, outfeed etc) sized to prevent reaching through to dangerous parts?					
6. Are fixed guards secured with fastenings, which require a tool?					
7. Do operators have safe methods for dealing with 'jam-ups', blockages, faults etc.?					
8. Have assessments considered possible needs for technicians to override or remove guard systems for setting/maintenance/fault diagnosis whilst the machine is operating?					
Answer Total					
Number of not applicable questions ticked					

Building/Maintenance

Part A Volume		Score
New premises (less than 10 years old)		1
Small premises less than $1000m^2$		
Older premises		2

Part B Significance Factor

Severity of Outcome (S)		*Degree of Control (C)*		*Business Risk (BR)*	
Minor injury, short term ill health, minor environmental impact	1	Best Practice standards	1	Limited impact if worst case scenario	1
Major injury ill health causing loss of at least 1 week, damage to species such as fish poisoning	2	Meeting legal compliance with full management and documentation.	2	Limited effects, no production loss, limited local publicity	2
Death/permanent ill-health or significant species damage	3	Meeting legal compliance with limited documentation or systems	3	Short term loss (loss of weeks) Enforcement Notice	3
		Below legal compliance	4	Death, damage to production and/or major environmental impact causing adverse publicity and fine	4
				Multiple death, significant damage to production causing possible permanent loss and/or major environmental impact causing significant adverse publicity	5
Severity of Outcome (S)		**Degree of Control (C)**		**Business Risk (BR)**	

Part B Significance Factor (S) × (C) × (BR) =

Part C Score = Part A Volume × Part B Significance Factor

	Part A Score	**Part B Score**
Total		
	1-40	**41-80**	**81- 120**
Overall Significance Factor	**Low**	**Medium**	**High**

Criteria Building/Maintenance					
Questions (Score)	1	3	5	N/A	Comments
	No/Never/None	Some/50%/sometimes	Yes/Always/All		
1. Is the roof free from leaks?					
2. Are all areas where a person could fall <2 m provided with barriers, rails or similar?					
3. Can windows, skylights and ventilators all be opened safely and do they work?					
4. Can window cleaning be carried out in a safe manner?					
5. Are glass panels in doors/partitions/walls clearly labeled and of safety material or protected where necessary					
6. Do maintenance staff know if asbestos is present and if so its location?					
7. Is fixed pipework (i.e. pneumatics, hydraulics, chemicals, water, gas etc):					
(a) In a safe position?					
(b) Securely fixed?					
(c) Identified (colour coded or labeled)?					
8. Floors/Passages/Stairs					
(a) Are they free of tripping hazards?					
(b) Are they unobstructed?					
(c) Are they adequately lit?					
(d) Do stair treads have a non-slip surface?					
9. Are lighting levels adequate and appropriate in work areas?					
10. Are fragile roof areas marked at likely access points?					
11. Is the site perimeter secure against trespassers?					
Answer Total					
Number of not applicable questions ticked					

Internal Transport

Part A Volume		Score
No internal transport		1
Use of internal transport none powered		
Use of internal transport powered		2

Part B Significance Factor

Severity of Outcome (S)		*Degree of Control (C)*		*Business Risk (BR)*	
Minor injury, short term ill health, minor environmental impact	1	Best Practice standards	1	Limited impact if worst case scenario	1
Major injury ill health causing loss of at least 1 week, damage to species such as fish poisoning	2	Meeting legal compliance with full management and documentation.	2	Limited effects, no production loss, limited local publicity	2
Death/permanent ill-health or significant species damage	3	Meeting legal compliance with limited documentation or systems	3	Short term loss (loss of weeks) Enforcement Notice	3
		Below legal compliance	4	Death, damage to production and/or major environmental impact causing adverse publicity and fine	4
				Multiple death, significant damage to production causing possible permanent loss and/or major environmental impact causing significant adverse publicity	5
Severity of Outcome (S)		**Degree of Control (C)**		**Business Risk (BR)**	

Part B Significance Factor (S) × (C) × (BR) =	
Part C Score = Part A Volume × Part B Significance Factor	

	Part A Score	**Part B Score**
Total		

	1-40	**41-80**	**81- 120**
Overall Significance Factor	**Low**	**Medium**	**High**

Criteria Transport					
Questions (Score)	1	3	5	N/A	Comments
	No/Never/None	Some/50%/sometimes	Yes/Always/All		
1. Is the workplace organised in such a way as to segregate pedestrians and vehicles as far as possible?					
2. Are vehicle routes marked?					
3. Are there barriers provided where doors or walkways open directly onto a vehicle route					
4. Where workstations are located close to vehicular routes are there barriers to protect the operatives?					
5. Are mirrors or other warning devices provided at particularly dangerous points such as blind corners?					
6. Are there pedestrian crossings where people require regular access across traffic routes?					
7. Is their sufficient space for vehicle maneuvering?					
8. Is hazardous storage's separated or protected from vehicle impact?					
9. Is there a one way system for external roads (where practicable)?					
10. Is reversing of goods vehicles avoided where practicable?					
11. Do reversing road vehicles have reversing alarms fitted?					
12. Are the fork trucks provided with flashing lights and horns, and do they all work?					
13. Are all drivers using forklift trucks trained and certificated?					
14. Do all doors used by ForkLift Trucks have vision panels except if automatic?					
15. How much control of contractor vehicles is maintained?					
Answer Total					
Number of not applicable questions ticked					

Electrical safety

Part A Volume		Score
Office type environment using max 240v		1
Factory environment using 415 3 phase supply		
Use of 240v portable equipment		2
"live" electrical testing		

Part B Significance Factor

Severity of Outcome (S)		*Degree of Control (C)*		*Business Risk (BR)*	
Minor injury, short term ill health, minor environmental impact	1	Best Practice standards	1	Limited impact if worst case scenario	1
Major injury ill health causing loss of at least 1 week, damage to species such as fish poisoning	2	Meeting legal compliance with full management and documentation.	2	Limited effects, no production loss, limited local publicity	2
Death/permanent ill-health or significant species damage	3	Meeting legal compliance with limited documentation or systems	3	Short term loss (loss of weeks) Enforcement Notice	3
		Below legal compliance	4	Death, damage to production and/or major environmental impact causing adverse publicity and fine	4
				Multiple death, significant damage to production causing possible permanent loss and/or major environmental impact causing significant adverse publicity	5
Severity of Outcome (S)		**Degree of Control (C)**		**Business Risk (BR)**	
Part B Significance Factor (S) × (C) × (BR) =					

Part C Score = Part A Volume × Part B Significance Factor

	Part A Score	**Part B Score**
Total		
	1-40	**41-80**	**81- 120**
Overall Significance Factor	**Low**	**Medium**	**High**

Criteria Electrical Safety					
Questions (Score)	1	3	5	N/A	Comments
	No/Never/None	Some/50%/sometimes	Yes/Always/All		
1. Are all control panels, isolators and switch gear marked and fitted with the correct lock-off facilities					
2. Is there local means for cutting off the supplies to motors and other electrical equipment?					
3. Are control panels closed and locked?					
4. Are earthing connections in good condition?					
5. Where portable tools are used, are they 110 volts or less?					
6. Are flexible cables damage free?					
7. Where portable tools are used, are the cables stored neatly and not allowed to trail across the floor?					
8. Are RCD's subject to regular mechanical testing?					
Answer Total					
Number of not applicable questions ticked					

Hand Arm Vibration

Part A Volume		Score
Little tasks involving exposure to vibration		1
Some (less than 2 hours per day) tasks involving exposure to vibration		
Frequent (more than 2 hours per day) tasks involving exposure to vibration		2

Part B Significance Factor

Severity of Outcome (S)		*Degree of Control (C)*		*Business Risk (BR)*	
Minor injury, short term ill health, minor environmental impact	1	Best Practice standards	1	Limited impact if worst case scenario	1
Major injury ill health causing loss of at least 1 week, damage to species such as fish poisoning	2	Meeting legal compliance with full management and documentation.	2	Limited effects, no production loss, limited local publicity	2
Death/permanent ill-health or significant species damage	3	Meeting legal compliance with limited documentation or systems	3	Short term loss (loss of weeks) Enforcement Notice	3
		Below legal compliance	4	Death, damage to production and/or major environmental impact causing adverse publicity and fine	4
				Multiple death, significant damage to production causing possible permanent loss and/or major environmental impact causing significant adverse publicity	5
Severity of Outcome (S)		**Degree of Control (C)**		**Business Risk (BR)**	

Part B Significance Factor (S) × (C) × (BR) =

Part C Score = Part A Volume × Part B Significance Factor

	Part A Score	**Part B Score**
Total		
	1-40	**41-80**	**81- 120**
Overall Significance Factor	**Low**	**Medium**	**High**

Criteria Hand Arm Vibration					
Questions (Score)	1	3	5	N/A	Comments
	No/Never/None	Some/50%/sometimes	Yes/Always/All		
1. Do any of the processes generate obvious significant amounts of vibration?					
2. Has a survey for hand arm vibration been undertaken?					
3. Have frequencies of 2 to 1500 Hz been identified?					
4. Is there any vibration reduction programme in place?					
5. Are employees subject to health monitoring?					
6. Are employees aware of the health risks associated with HAV?					
7. Do employees wear PPE					
8. Are heated gloves provided were appreciate?					
9. Are employees provided with training on risk reduction controls?					
Answer Total					
Number of not applicable questions ticked					

Substances Hazardous to Health

Part A Volume		Score
Low use of substances		
Factory processes		2
Use of substances with MEL		

Part B Significance Factor

Severity of Outcome (S)		*Degree of Control (C)*		*Business Risk (BR)*	
Minor injury, short term ill health, minor environmental impact	1	Best Practice standards	1	Limited impact if worst case scenario	1
Major injury ill health causing loss of at least 1 week, damage to species such as fish poisoning	2	Meeting legal compliance with full management and documentation.	2	Limited effects, no production loss, limited local publicity	2
Death/permanent ill-health or significant species damage	3	Meeting legal compliance with limited documentation or systems	3	Short term loss (loss of weeks) Enforcement Notice	3
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				Multiple death, significant damage to production causing possible permanent loss and/or major environmental impact causing significant adverse publicity	5
Severity of Outcome (S)		**Degree of Control (C)**		**Business Risk (BR)**	

Part B Significance Factor (S) × (C) × (BR) =

Part C Score = Part A Volume × Part B Significance Factor

	Part A Score	**Part B Score**
Total		

	1-40	**41-80**	**81- 120**
Overall Significance Factor	**Low**	**Medium**	**High**

Criteria Hazardous Substances					
Questions (Score)	1	3	5	N/A	Comments
	No/Never/None	Some/50%/sometimes	Yes/Always/All		
1. Have COSHH assessments covering all potential exposures to hazardous substances in the area been completed?					
2. Have COSHH assessments included maintenance activities?					
3. Have all recommendations arising from assessment been implemented (or is a program of work in hand)?					
4. When were all COSHH assessments last reviewed?	More than 2 years	Within the last 2 years	Within the last year		
5. Is the chemical storage clean and tidy and free from spillage/leakage					
6. Have employees been provided with:					
a) The results of relevant COSHH assessments					
b) The results of any air monitoring carried out.					
c) The results of any health surveillance being carried out.					
d) Information about the risks of the substances they are exposed to.					
e) Information about the precautions they should take to protect them.					
f) Training and instruction about the use of Personal Protective Equipment PPE					
Is all Local Extraction Ventilation equipment examined and tested at least every 14 months and records kept?					
7. Are recommendations following Local Extraction Ventilation (LEV) examinations promptly attended to?					
8. Are employees who may be at risk of Occupations asthma undergoing health surveillance at specific intervals					
9. Is pre-employment screening carried out for those who may work with agents, which may cause occupational asthma?					
10. Is respiratory protective equipment of the right type, in good clean condition and with a suitable storage place?					
11. Is non-disposable RPE examined and serviced at least monthly and are records of this being kept?					
12. Are chemicals moved into/out of/around the area in a safe manner?					
13. Are precautions against Legionella taken if the hot water tank has greater capacity than 300 litres					
14. Are precautions taken against Legionella if there are "open system" water cooling units?					
Answer Total					
Number of not applicable questions ticked					

Manual Handling

Part A Volume		Score
Limited lifting operations		1
Numerous lifting tasks of "light" loads below chart values		
Tasks involve lifting above chart values		2
Many frequent activities involve lifting above chart values		

Part B Significance Factor

Severity of Outcome (S)		*Degree of Control (C)*		*Business Risk (BR)*	
Minor injury, short term ill health, minor environmental impact	1	Best Practice standards	1	Limited impact if worst case scenario	1
Major injury ill health causing loss of at least 1 week, damage to species such as fish poisoning	2	Meeting legal compliance with full management and documentation.	2	Limited effects, no production loss, limited local publicity	2
Death/permanent ill-health or significant species damage	3	Meeting legal compliance with limited documentation or systems	3	Short term loss (loss of weeks) Enforcement Notice	3
		Below legal compliance	4	Death, damage to production and/or major environmental impact causing adverse publicity and fine	4
				Multiple death, significant damage to production causing possible permanent loss and/or major environmental impact causing significant adverse publicity	5
Severity of Outcome (S)		**Degree of Control (C)**		**Business Risk (BR)**	

Part B Significance Factor (S) × (C) × (BR) =

Part C Score = Part A Volume × Part B Significance Factor

	Part A Score	**Part B Score**
Total		
	1-40	**41-80**	**81- 120**
Overall Significance Factor	**Low**	**Medium**	**High**

Criteria Manual Handling					
Questions (Score)	1	3	5	N/A	Comments
	No/Never/None	Some/50%/sometimes	Yes/Always/All		
1. Have written risk assessments been carried out on all potentially hazardous manual handling activities (except for simple situations).					
2. Have the assessors received training in assessment techniques?					
3. Have employees been involved in the assessment recess?					
4. Have actions identified as necessary by the assessments been implemented or in hand?					
5. Have completed actions been recorded/indicated in the risk assessments					
6. Have employees at risk received instruction and training in safe/unsafe lifting practices					
7. Are the relevant assessments reviewed following accidents?					
8. How long since all manual handling assessments were last reviewed?					
Answer Total					
Number of not applicable questions ticked					

ENERGY USAGE

Part A Volume			Score
Electricity Lighting Non-continuous machinery use Continuous machinery use (including transport)	Gas No usage Minor user (heating only) Major user (heating and process usage)		1 2

Part B Significance Factor

Severity of Outcome (S)		*Degree of Control (C)*		*Business Risk (BR)*	
Minor injury, short term ill health, minor environmental impact	1	Best Practice standards	1	Limited impact if worst case scenario	1
Major injury ill health causing loss of at least 1 week, damage to species such as fish poisoning	2	Meeting legal compliance with full management and documentation.	2	Limited effects, no production loss, limited local publicity	2
Death/permanent ill-health or significant species damage	3	Meeting legal compliance with limited documentation or systems	3	Short term loss (loss of weeks) Enforcement Notice	3
		Below legal compliance	4	Death, damage to production and/or major environmental impact causing adverse publicity and fine	4
				Multiple death, significant damage to production causing possible permanent loss and/or major environmental impact causing significant adverse publicity	5
Severity of Outcome (S)		**Degree of Control (C)**		**Business Risk (BR)**	

Part B Significance Factor (S) × (C) × (BR) =

Part C Score = Part A Volume × Part B Significance Factor

	Part A Score	**Part B Score**

Total			
	1-40	**41-80**	**81- 120**
Overall Significance Factor	**Low**	**Medium**	**High**

Criteria Energy Usage					
Questions (Score)	1	3	5	N/A	Comments
	No/Never/None	Some/50%/sometimes	Yes/Always/All		
1. Is the amount of energy used known?					
2. Are process calculated in terms of energy usage					
3. Have the biggest uses of engery been identified?					
4. Is there a programme of energy reduction measures in place?					
5. Has energy usage decreased in the last year?					
6. Has energy usage increased in the last year?					
7. Is there an employee campaign to promote energy reduction measures?					
Answer Total					
Number of not applicable questions ticked					

Noise

Part A Volume		Score
Always Levels below 85 dB(A)		1
Occasional exposure for short periods above 85 dB(A)		
Exposure above 85 dB(A) for 8hours		2
Exposure above 90dB(A)		

Part B Significance Factor

Severity of Outcome (S)		*Degree of Control (C)*		*Business Risk (BR)*	
Minor injury, short term ill health, minor environmental impact	1	Best Practice standards	1	Limited impact if worst case scenario	1
Major injury ill health causing loss of at least 1 week, damage to species such as fish poisoning	2	Meeting legal compliance with full management and documentation.	2	Limited effects, no production loss, limited local publicity	2
Death/permanent ill-health or significant species damage	3	Meeting legal compliance with limited documentation or systems	3	Short term loss (loss of weeks) Enforcement Notice	3
		Below legal compliance	4	Death, damage to production and/or major environmental impact causing adverse publicity and fine	4
				Multiple death, significant damage to production causing possible permanent loss and/or major environmental impact causing significant adverse publicity	5
Severity of Outcome (S)		**Degree of Control (C)**		**Business Risk (BR)**	
Part B Significance Factor (S) × (C) × (BR) =					

Part C Score = Part A Volume × Part B Significance Factor

	Part A Score	**Part B Score**
Total		

	1-40	**41-80**	**81- 120**
Overall Significance Factor	**Low**	**Medium**	**High**

Criteria Noise					
Questions (Score)	1	3	5	N/A	Comments
	No/Never/None	Some/50%/sometimes	Yes/Always/All		
Noise induced hearing Loss					
1. Is there a written noise assessment report available for the area?					
2. Is it fully up to date?					
3. Have all employees exposed above the First Action Level (85 dBA) been informed of the risk to their hearing and of the availability of hearing protection?					
4. Have zones which exceed the Section Action Level (90 dBA) been clearly marked?					
5. Is a selection of different types of hearing protector available for employees?					
6. Is hearing protection mandatory (including short period visitors) in zones above the Second Action Level and is there compliance in practice?					
7. Are non-disposable hearing protectors subject to a formal regular examination and are records kept of such examination?					
8. Is audimetry being carried out on all employees where noise dose exceeds The Second Action Level?					
Environmental Noise					
9. Has the noise levels at the boundary been measured?					
10. Are there any planning restrictions on the levels of boundary noise?					
11. Have there been any complains of excessive noise been received within the last 12 months?	Yes		No		
12. Has action been taken to reduce the level of boundary noise/					
13. Is silent hours' working being undertaken?	Yes	Some	No		
Answer Total					
Number of not applicable questions ticked					

SOLID WASTE GENERATION

Part A Volume		Score
No significant waste generation (less than one 50 litre wheelie bin per week)		1
Small quantities of special / hazardous waste produced (less than one 50 litre wheelie bin per week)		
Some waste recycling / reuse but less than 50%		2
Regular significant quantities of special / hazardous waste produced		

Part B Significance Factor

Severity of Outcome (S)		*Degree of Control (C)*		*Business Risk (BR)*	
Minor injury, short term ill health, minor environmental impact	1	Best Practice standards	1	Limited impact if worst case scenario	1
Major injury ill health causing loss of at least 1 week, damage to species such as fish poisoning	2	Meeting legal compliance with full management and documentation.	2	Limited effects, no production loss, limited local publicity	2
Death/permanent ill-health or significant species damage	3	Meeting legal compliance with limited documentation or systems	3	Short term loss (loss of weeks) Enforcement Notice	3
		Below legal compliance	4	Death, damage to production and/or major environmental impact causing adverse publicity and fine	4
				Multiple death, significant damage to production causing possible permanent loss and/or major environmental impact causing significant adverse publicity	5
Severity of Outcome (S)		**Degree of Control (C)**		**Business Risk (BR)**	

Part B Significance Factor (S) × (C) × (BR) =	

Part C Score = Part A Volume × Part B Significance Factor

	Part A Score	**Part B Score**
Total		
	1-40	**41-80**	**81- 120**
Overall Significance Factor	**Low**	**Medium**	**High**

Criteria Solid Waste	1	3	5	N/A	Comments
Questions (Score)	No/Never/None	Some/50%/sometimes	Yes/Always/All		
1. Are operational controls relating to waste management adequate and effective?					
2. Is there an ongoing improvement activity associated with waste management?					
3. Can improved environmental performance be demonstrated as a result of management programme activities?					
4. Are there any wastes generated in significant quantities in the area that could be recycled but currently are not?					
5. Has responsibility for waste management been allocated to staff?					
6. Have individuals with specific responsibilities for waste management received any specialist training?					
Answer Total					
Number of not applicable questions ticked					

ATMOSPHERIC EMISSIONS (including dust and odour)

Part A Volume		Score
No direct atmospheric emissions possible		1
Irregular / periodic non - LAAPC emissions		2
Non LAAPC emissions but constant / frequent & predictable		

Part B Significance Factor

Severity of Outcome (S)		*Degree of Control (C)*		*Business Risk (BR)*	
Minor injury, short term ill health, minor environmental impact	1	Best Practice standards	1	Limited impact if worst case scenario	1
Major injury ill health causing loss of at least 1 week, damage to species such as fish poisoning	2	Meeting legal compliance with full management and documentation.	2	Limited effects, no production loss, limited local publicity	2
Death/permanent ill-health or significant species damage	3	Meeting legal compliance with limited documentation or systems	3	Short term loss (loss of weeks) Enforcement Notice	3
		Below legal compliance	4	Death, damage to production and/or major environmental impact causing adverse publicity and fine	4
				Multiple death, significant damage to production causing possible permanent loss and/or major environmental impact causing significant adverse publicity	5
Severity of Outcome (S)		**Degree of Control (C)**		**Business Risk (BR)**	

Part B Significance Factor (S) × (C) × (BR) =	

Part C Score = Part A Volume × Part B Significance Factor

	Part A Score	**Part B Score**
Total		

	1-40	**41-80**	**81- 120**
Overall Significance Factor	**Low**	**Medium**	**High**

Criteria Air Emissions					
Questions (Score)	1	3	5	N/A	Comments
	No/Never/None	Some/50%/sometimes	Yes/Always/All		
1. Are all process emissions identified					
2. Are sources of fugative emissions identified					
3. Is regular monitoring of emissions undertaken					
4. Are results of air emissions within the environmental targets					
5. Are results of air emissions within the permissible consents					
6. Have any complaints re nuisance emissions been received since the last audit	Yes		No		
7. Are employees informed of the results of these emissions					
8. Are members of the public informed of the results of these emissions					
9. Is there any projects being considered to reduce emissions					
Answer Total					
Number of not applicable questions ticked					

WATER USAGE

Part A Volume		Score
"Domestic" type water use		1
Process usage - periodic and/or small quantities		
Non process use but significant use for washing down		2
Process usage - frequent / continuous		

Part B Significance Factor

Severity of Outcome (S)		*Degree of Control (C)*		*Business Risk (BR)*	
Minor injury, short term ill health, minor environmental impact	1	Best Practice standards	1	Limited impact if worst case scenario	1
Major injury ill health causing loss of at least 1 week, damage to species such as fish poisoning	2	Meeting legal compliance with full management and documentation.	2	Limited effects, no production loss, limited local publicity	2
Death/permanent ill-health or significant species damage	3	Meeting legal compliance with limited documentation or systems	3	Short term loss (loss of weeks) Enforcement Notice	3
		Below legal compliance	4	Death, damage to production and/or major environmental impact causing adverse publicity and fine	4
				Multiple death, significant damage to production causing possible permanent loss and/or major environmental impact causing significant adverse publicity	5
Severity of Outcome (S)		**Degree of Control (C)**		**Business Risk (BR)**	

Part B Significance Factor = (S) × (C) × (BR) =

Part C Score = Part A Volume × Part B Significance Factor

	Part A Score	**Part B Score**
Total		

	1-40	**41-80**	**81- 120**
Overall Significance Factor	**Low**	**Medium**	**High**

Criteria Water Usage					
Questions (Score)	1	3	5	N/A	Comments
	No/Never/None	Some/50%/sometimes	Yes/Always/All		
1. Is the water usage known?					
2. Has water usage decreased in the last year?	No	10%	20+%		
3. Has water usage increased in the last year?	>20%	10%	No		
4. Is there a programme to reduce water usage?					
Answer Total					
Number of not applicable questions ticked					

Liquid Discharges

Part A Volume		Score
"Domestic" type water use		1
Process usage - periodic and/or small quantities		
Process usage - frequent / continuous		2

Part B Significance Factor					
Severity of Outcome (S)		***Degree of Control (C)***		***Business Risk (BR)***	
Minor injury, short term ill health, minor environmental impact	1	Best Practice standards	1	Limited impact if worst case scenario	1
Major injury ill health causing loss of at least 1 week, damage to species such as fish poisoning	2	Meeting legal compliance with full management and documentation.	2	Limited effects, no production loss, limited local publicity	2
Death/permanent ill-health or significant species damage	3	Meeting legal compliance with limited documentation or systems	3	Short term loss (loss of weeks) Enforcement Notice	3
		Below legal compliance	4	Death, damage to production and/or major environmental impact causing adverse publicity and fine	4
				Multiple death, significant damage to production causing possible permanent loss and/or major environmental impact causing significant adverse publicity	5
Severity of Outcome (S)		**Degree of Control (C)**		**Business Risk (BR)**	
Part B Significance Factor = (S) × (C) × (BR) =					

Part C Score = Part A Volume × Part B Significance Factor			
	Part A Score	**Part B Score**	
Total			
	1-40	**41-80**	**81- 120**
Overall Significance Factor	**Low**	**Medium**	**High**

Criteria Liquid Discharges					
Questions (Score)	1	3	5	N/A	Comments
	No/Never/None	Some/50%/sometimes	Yes/Always/All		
1. Are the conditions of the discharge consent available?					
2. Does the results of the monitoring indicate that the consent conditions in terms of quality are met					
3. Does the results of the monitoring indicate that the consent conditions in terms of quantity are met?					
4. Are there detailed maps of sewerage and drainage?					
5. Has provision been made for fire fighting water discharge?					
6. Is there a programme to reduce liquid effect emissions?					
7. If so by how much has the usage decreased in the last year	No	10%	20%+		
Answer Total					
Number of not applicable questions ticked					

RAW MATERIALS USAGE

Part A Volume		Score
Used in small quantities (e.g. periodic support usage)		1
Used in medium quantities (e.g. frequent/continuous support usage)		
Use of non-renewable and non-recyclable resources (e.g. mixed plastic)		2
Used in large quantities (e.g. product / process usage)		

Part B Significance Factor

Severity of Outcome (S)		*Degree of Control (C)*		*Business Risk (BR)*	
Minor injury, short term ill health, minor environmental impact	1	Best Practice standards	1	Limited impact if worst case scenario	1
Major injury ill health causing loss of at least 1 week, damage to species such as fish poisoning	2	Meeting legal compliance with full management and documentation.	2	Limited effects, no production loss, limited local publicity	2
Death/permanent ill-health or significant species damage	3	Meeting legal compliance with limited documentation or systems	3	Short term loss (loss of weeks) Enforcement Notice	3
		Below legal compliance	4	Death, damage to production and/or major environmental impact causing adverse publicity and fine	4
				Multiple death, significant damage to production causing possible permanent loss and/or major environmental impact causing significant adverse publicity	5
Severity of Outcome (S)		**Degree of Control (C)**		**Business Risk (BR)**	
Part B Significance Factor = (S) × (C) × (BR) =					

Part C Score = Part A Volume × Part B Significance Factor

	Part A Score	**Part B Score**
Total		

	1-40	**41-80**	**81- 120**
Overall Significance Factor	**Low**	**Medium**	**High**

Criteria Raw Materials					
Questions (Score)					
	1	3	5	N/A	Comments
	No/Never/None	Some/50%/sometimes	Yes/Always/All		
1. Are all raw materials used identified?					
2. Has a mass balance been undertaken of raw material usage					
3. Is there a programme of phasing out or reducing the usage of hazardous raw materials					
4. Is the use of all packaging materials known?					
5. Is there a programme of phasing out or reducing the usage of packaging materials?					
Answer Total					
Number of not applicable questions ticked					

TOTALS AUDIT ELEMENT B

	Score	No of n/a answers	B × 5	Adjusted score A + C	Number of questions	Maximum possible score	Adjusted Score (D) / Maximum Possible Score (F)	Significance factor			Total (T) G × H = T	Max total I × H = K
Chapter Headings	A	B	C	D	E	F	G	H			T	K
								High	Low	None		
								× 2.5	× 1	× 0.5		
1. Contractors					10	50						
2. Fire					14	70						
3. Housekeeping					17	85						
4. Machinery					8	40						
5. Building					11	55						
6. Transport					15	75						
7. Electrical					8	40						
8. HAV					9	45						
9. COSHH					19	95						
10. Manual Handling					8	40						
11. Noise					7	35						
12. Energy					13	65						
13. Solid Waste					6	30						
14. Water Usage					4	20						
15. Liquid Discharges					7	35						
16. Raw Materials					5	25						
17. Air Emissions					9	45						
TOTAL number of high/medium/low questions												
Significance rating Number × Significance rating								× 2.5	× 1	× 0.5		
Max score available (I)												
Total Σ T												
Total Score Σ K												

TOTALS AUDIT ELEMENT B = $\frac{\text{Total Score } \Sigma T}{\text{Max Total } \Sigma K} \; 3\,100 = B\,\%$

TOTALS AUDIT ELEMENT A	
TOTALS AUDIT ELEMENT B	
TOTAL OVERALL PERFORMANCE RATING OF EHS MANAGEMENT SYSTEM $A+B = \frac{A+B}{2}$	

E	D	C	B	A
0-20	21-40	41-60	61-80	81-100

Category A:

Meets governmental and/or THE COMPANY requirements. The unit complies with most, if not all, of the applicable requirements reviewed. For those requirements where exceptions are noted, these departures are occasional, anomalous and inconsequential in comparison to the overall level of compliance achieved.

Category B:

Substantially meets governmental and/or THE COMPANY requirements. The site complies with most of the applicable requirements reviewed, and only a few requirements were not satisfied. These departures, however, represent isolated and anomalous exceptions in an otherwise effective Compliance programme.

Category C:

Generally meets governmental and/or THE COMPANY requirements except as noted. The site complies with many, but not most of the applicable requirements reviewed. The exceptions noted are not analogous, but reflect patterns or weaknesses in the design and/or implementation of compliance programmed

Category D:

Requires improvement to meet governmental and/or THE COMPANY requirements. The site complies with some of the applicable requirements reviewed, but many were not satisfied. The exceptions noted reflects the absence of required programmed significant departures from established criteria, or lapses in programme implementation.

Category E:

Requires substantial improvement to meet governmental and/or THE COMPANY requirements. The site complies with a few of the applicable requirements reviewed and most were not satisfied. The exceptions noted include several significant departures from established criteria, the absence of several required programmed or prolonged inattention to the resolution of previous identified compliance or liability issues.

Notes to Auditors

Purpose

The purpose of this audit of Environmental, Health and Safety (EH&S) standards is to:

- Determine that the control standards of EH&S noted during the audit conform at least to minimum legal standards.
- Determine whether the auditee's EH&S management system has been properly implemented and maintained.
- Identify areas of potential improvement in the auditee's EH&S management system.
- Assess the ability of the internal management review process to ensure the continuing suitability and effectiveness of the EH&S management system.

Background

The audit has been developed to allow a 'score' of the performance of an organisation against this HSE management standard. The score is composed of three elements:

Part A	Score result of performance against the management standard
Part B	Score result of performance against the physical standards of health safety and environment
Weighting Factor	Score adjusted depending upon the significance of any of the physical standards of health safety and environment topics.

Methodology

It is anticipated that the physical inspection of the site will take between 1 and 2 days, including feedback,

Prior to visiting the site, the auditor should familiarise himself with the company's heath, safety and environmental documentation and manual.

Once on site, the inspection should take place with both the auditor and the Plant Manager.

It is recommended that the inspection is undertaken in a process flow order.

The audit questions are ***not task based, but topic based*** and therefore the questionnaire cannot always be completed until the end of the inspection. It is recommended that a photocopy of the inspection be taken, which can be used for making rough notes, comments and as a reminder of the topics to be covered during the inspection.

In addition the audit questions seek to determine the significance of a particular topic in the overall management of EH&S risk. Therefore for each topic the auditor will as a result of the question be able to determine the overall significance.

As part of the audit, the questions are designed to test both employee's understanding and knowledge of health, safety and environmental issues and therefore it will be necessary to discuss these issues with the relevant personnel.

It is not intended that this inspection will examine paperwork, licenses, consents etc. This is the purpose of the two yearly audit.

Remember the prime purpose of this inspection is to continuously improve the standards of health, safety and environment at our sites. This can only be achieved through the co-operation and the commitment of all parties.

Details of the Report Form

Page one contains the basic details of the audit and site

Page 3 onward contains the management audit questions. Each subsection of the management standard will contain appropriate standards. Please select the relevant criteria and tick the box.

1	3	5	N/A	Comment
No/Never/None	Some/50%/ sometimes	Yes/Always/All		

Page 9 contains the specific topics audit questions. Please select the relevant criteria and tick the box. Then circle the appropriate low, medium or high category

Part A Volume			Score
			1
			2

Part B Significance Factor					
Severity of Outcome (S)		***Degree of Control (C)***		***Business Risk (BR)***	
Minor injury, short term ill health, minor environmental impact	1	Best Practice standards	1	Limited impact if worst case scenario	1
Major injury ill health causing loss of at least 1 week, damage to species such as fish poisoning	2	Meeting legal compliance with full management and documentation.	2	Limited effects, no production loss, limited local publicity	2
Death/permanent ill-health or significant species damage	3	Meeting legal compliance with limited documentation or systems	3	Short term loss (loss of weeks) Enforcement Notice	3
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				Multiple death, significant damage to production causing possible permanent loss and/or major environmental impact causing significant adverse publicity	5
Severity of Outcome (S)		**Degree of Control (C)**		**Business Risk (BR)**	
Part B Significance Factor (S) × (C) × (BR) =					

Part C Score = Part A Volume × Part B Significance Factor			
	Part A Score	**Part B Score**	
Total			
	1-40	**41-80**	**81- 120**
Overall Significance Factor	**Low**	**Medium**	**High**

Topic Questions

There is then a series of mandatory questions for each of the Part B topic, which should be completed. The questions seek to answer one of the following options

1	3	5	N/A	Comment
No/Never/None	Some/50%/ sometimes	Yes/Always/All		

Please tick the appropriate box for each question.
If there is a negative answer to the question then score 1
If there is some compliance with the question then score 3
If there is full compliance with the question then score 5
If the question is not relevant tick the n/a box

On completion of the question for each topic, the summary score box at the end should be completed. The score, the number of applicable questions and the significance factor should be then transferred to page 26
When all chapters are complete and the scores have been transferred to page 26.

	Score	No of n/a answers	B ×5	Adjusted score A + C	Number of questions	Maximum possible score	$\frac{\text{Adjusted Score (D)}}{\text{Maximum Possible Score (F)}} \times 100$	Significance factor			Total (T)
Chapter Headings	A	B	C	D	E	F	G	H			G × H = T
								High	Low	None	
								× 2.5	× 1	× 0.5	

Complete each box as above. The following notes will assist:

Box A
The transferred total score from each topic sheet

Box B
The number of n/a questions ticked from each topic sheet

Box C
The number of n/a questions ticked from each topic sheet multiplied by 5. This factor is to correct for the number of questions per topic that are not relevant and would 'bias' the overall score

Box D
Results of box A and C are added together to give an accurate total score per topic

Box E
The total number of questions per topic this has been already calculated for you.

Box F
The maximum score per topic, this has been already calculated for you.

Box G
Now calculate the actual score divided by the maximum score × 100. This gives a % performance rating

Box H
The significance factor from each topic sheet

Box T
The total performance rating factor multiplied by the significance factor

Each Chapter heading Box T score is added together to give a Total score for part B.
This value is divided by the maximum possible weighted score for Part B and the results expressed as a fraction.

This score is transferred to page 44 where it is added to the faction score obtained from part A to give an overall performance rating. Please note that this score DOES NOT HAVE TO BE COMPLETED BY THE AUDITOR if time does not permit. This can be calculated later.

Tips to Auditors

- Remember to keep an open mind.
- Please refer to company standards for comparative checks.
- One of the objectives of this audit is to test the employees understanding of health, safety and environmental issues and procedures.
- Please be friendly and open in your approach. Remember that we are all on the same side!
- If in doubt with any topic, never hesitate to contact your Safety or Environmental Manager for assistance.